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TRANSACTIONS

OF THE

OTOLOGICAL SOCIETY

OF THE

UNITED KINGDOM

VOLUME THE FIFTH

COMPRISING THE REPORT OF THE PROCEEDINGS FOR THE FIFTH SESSION, 1903–1904.

Edited by Jobson Horne, M.D.

LONDON
J. & A. CHURCHILL
7 GREAT MARLBOROUGH STREET
1904

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PAST PRESIDENTS

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THE OTOLOGICAL SOCIETY
OF THE UNITED KINGDOM

OFFICERS AND COUNCIL

ELECTED DECEMBER 7, 1903

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LIST OF MEMBERS OF THE SOCIETY

Honorary Member.

Professor ADAM POLITZER, Vienna.

EXPLANATION OF ABBREVIATIONS.

P = President.	*L* = Honorary Librarian.
VP = Vice-President.	*C* = Councillor.
T = Honorary Treasurer.	*S* = Honorary Secretary.
Italics = Original Members.	*E* = Honorary Editor of the "Transactions."

The abbreviations placed after a Member's name indicate offices which have been held by him.

N.B.—Members are reminded that they are, themselves, responsible for the correctness of the descriptions in the following lists, and it is particularly requested that any change of title, appointment, or residence, may be communicated to the Senior Secretary before July 1 in each year.

ABERCROMBIE, PETER HENDERSON, M.D.(Glasg.), 56 Harley St., W. Assistant Surgeon to the Central London Throat, Nose, and Ear Hospital. *Elected December* 2, 1901.

ADAMS, FREDERICK VASEY, F.F.P.S.(Glasg.), 10 Queen's Crescent, Glasgow. Assistant Surgeon to the Glasgow Ear Hospital. *Elected March* 3, 1902.

L *Baber, Edward Cresswell,* M.B., 46 Brunswick Square, Brighton, and 62 Brook St., W. Surgeon to the Brighton, Hove, and Sussex Throat and Ear Hospital.

Ball, James Barry, M.D., 12 Upper Wimpole St., W., Physician to the Throat, Nose, and Ear Department, West London Hospital.

VP *Ballance, Charles Alfred,* M.B., M.S., F.R.C.S., 106 Harley St. Late Aural Surgeon to St. Thomas's Hospital. *S.C.*

Ballance, Hamilton Ashley, M.D., M.S., F.R.C.S., 46 Prince of Wales Rd., Norwich.

P *Barr, Thomas,* M.D.(Glasg.), 13 Woodside Place, Charing Cross, Glasgow. Senior Surgeon to the Glasgow Hospital for Diseases of the Ear; Lecturer on Aural Surgery to the University of Glasgow. *VP.*

Bennett, Frederick William, M.D., 25 London Rd., Leicester. Surgeon to the Ear and Throat Department, Leicester Infirmary.

Benson, Arthur Henry, M.A., M.B.(Dub.), F.R.C.S.I., 42 Fitzwilliam Square, Dublin. Ophthalmic and Aural Surgeon to the City of Dublin Hospital.

Bond, James William, M.D., B.S., 26 Harley St., W. Physician to the Hospital for Diseases of the Throat, Golden Square.

Bronner, Adolph, M.D.(Heidelb.), 33 Manor Rd., Bradford, Yorks. Surgeon to the Bradford Eye and Ear Hospital. *C.*

Browne, John Walton, B.A., M.D., 10 College Square North, Belfast.

Bull, William Charles, B.A., M.B., F.R.C.S., 5 Clarges St., Mayfair, W. Aural Surgeon and Lecturer on Aural Surgery to St. George's Hospital.

CARSON, HERBERT WILLIAM, F.R.C.S., 26 Welbeck St., W. Surgeon in charge Throat and Ear Department, Tottenham Hospital. *Elected December* 1, 1902.

CATHCART, GEORGE CLARK, M.A., M.B., C.M.(Ed.), 35 Harley St., W. Assistant Surgeon to the London Throat Hospital. *Elected December* 3, 1900.

C *Cheatle, Arthur Henry,* F.R.C.S., 18 Savile Row, W. Assistant Aural Surgeon to King's College Hospital; Surgeon to the Royal Ear Hospital; Teacher of Aural Surgery to the Royal Army Medical College. *S.E.*

CONNAL, JAMES GALBRAITH, M.B., C.M., F.F.P.S.(Glasg.), 4 Burnbank Terrace, Glasgow. Lecturer on Aural Surgery to Anderson's College Medical School; Surgeon to the Throat and Nose Department, Central Dispensary, Glasgow; Assistant Surgeon to the Glasgow Ear Hospital. *Elected May* 2, 1903.

VP *Cumberbatch, Alphonso Elkin* M.B., F.R.C.S., 11 Park Crescent, Portland Place, W. Aural Surgeon, to St. Bartholomew's Hospital and National Hospital for the Paralysed and Epileptic, Queen's Square. *T.*

Dalby, Sir William Bartlett, B.A., M.B., F.R.C.S., 18 Savile Row, W. Consulting Aural Surgeon to St. George's Hospital. *P.C.*

DEANESLY, EDWARD, M.D., F.R.C.S., 4 Waterloo Rd., Wolverhampton. Aural Surgeon to the General Hospital, Wolverhampton. *Elected March* 3, 1902.

DONELAN, JAMES, M.B., M.Ch.(R.U.I.), 6 Manchester Square, W. Physiologist, Laryngologist, and Aurist to the Italian Hospital. *Elected February* 2, 1903.

FAGGE, CHARLES HERBERT, M.B., M.S., F.R.C.S., 22 St. Thomas's St., London Bridge. Aural Surgeon to Guy's Hospital. *Elected March* 5, 1900.

FARQUHARSON, JOHN MALCOLM, M.B., C.M., F.R.C.P.(Ed.), 2 Coates Pl., Edinburgh. Surgeon to the Edinburgh Ear, Nose and Throat Infirmary; Lecturer on Diseases of the Ear, Nose and Throat, School of Medicine of the Royal Colleges, Edinburgh. *Elected December* 2, 1901.

Field, George P., 34 Wimpole St., W. Consulting Aural Surgeon to St. Mary's Hospital. *VP.*

FULLERTON, ROBERT, M.D., M.C.(Ed.), 24 Newton Place, Glasgow. Honorary Consulting Surgeon for Diseases of the Throat, Nose and Ear, Greenock Infirmary; Surgeon to the Throat, Nose and Ear Department, Greenock Eye Infirmary. *Elected March* 4, 1901.

Grant, J. Dundas, M.A., M.D., F.R.C.S., 18 Cavendish Square, W. Surgeon to the Central London Throat and Ear Hospital, and Throat and Ear Department West End Hospital for Nervous Diseases. *C.*

GRAY, ALBERT ALEXANDER, M.D., F.F.P.S.(Glasg.), 14 Newton Terrace, Glasgow. Aural Surgeon to the Glasgow Central Dispensary. *Elected February* 3, 1901.

Guild, George Taylor, M.B., C.M.(Ed.), 164 Nethergate, Dundee. Surgeon to the Ear and Throat Department, Dundee Royal Infirmary; Lecturer on Diseases of the Ear and Throat to the University of St. Andrews.

Harvey, Frederick George, F.R.C.S.(Ed.), 4 Cavendish Place, W. Surgeon to the Hospital for Diseases of the Throat, Golden Square.

HEATH, CHARLES J., F.R.C.S., 3 Cavendish Place, W. Surgeon to the Hospital for Diseases of the Throat, Golden Square. *Elected March* 4, 1901.

Hill, George William, B.Sc., M.D., 28 Weymouth St., W. Aural Surgeon to St. Mary's Hospital.

E *Horne, Walter Jobson*, M.A., M.D., B.C.(Cantab.), M.R.C.P., 27 New Cavendish St., W. Surgeon to the Metropolitan Ear, Nose and Throat Hospital; in charge of Throat and Ear Department Farringdon General Dispensary. *S.*

Horsley, Sir Victor, F.R.S., 25 Cavendish Square, W. *C.*

Hovell, T. Mark, F.R.C.S.(Ed.), 105 Harley St., W. Consulting Aural Surgeon to the London Hospital. *C.*

Hunt, John Middlemass, M.B., C.M.(Glasg.), 55 Rodney St., Liverpool. Laryngologist to the Royal Infirmary, Liverpool.

JACKSON, GEORGE, F.R.C.S.(Eng.), 19 Portland Villas, Plymouth. Senior Surgeon to the Devon and Cornwall Ear and Throat Hospital. *Elected February* 1, 1904.

Jakins, Percy, M.D.(Dur.), 120 Harley St., W. Surgeon to the Central London Throat and Ear Hospital.

Johnston, Robert McKenzie, M.D., F.R.C.S.(Ed.), 2 Drumsheugh Gardens, Edinburgh. Assistant Surgeon for Ear and Throat to the Royal Infirmary, Edinburgh.

S *Jones, Hugh Edward*, 19 Rodney St., Liverpool. Surgeon to the Eye and Ear Infirmary, Liverpool; Ophthalmic and Aural Surgeon to the Royal Albert Edward Infirmary, Wigan. *C.*

Jones, Henry Macnaughton-, M.D., R.U.I., M.Ch., M.A.O. (Hon. Caus.), F.R.C.S.(I. and Ed.), 131 Harley St., W. Late Surgeon to the Eye, Ear and Throat Hospital, Cork.

Kelly, Adam Brown, B.Sc., M.B., C.M.(Glasg.), 26 Blythswood Square, Glasgow. Surgeon for Diseases of the Throat, Nose and Ear to the Victoria Infirmary and Bellahouston Dispensary.

KELSON, WILLIAM HENRY, M.D., F.R.C.S., 17 Cavendish Place, W. Assistant Surgeon to the London Throat Hospital. *Elected March* 3, 1902.

KERR, JAMES, M.A., M.D., D.P.H.(Cantab.), School Board Offices, Victoria Embankment. Late Surgeon to the Bradford Eye and Ear Hospital. *Elected February* 2, 1903.

Lake, Richard, F.R.C.S., 19 Harley St., W. Surgeon to the Royal Ear Hospital.

T *Law, Edward*, M.D., C.M.(Ed.), 8 Wimpole St., W. Surgeon to the London Throat Hospital. *C. V.P.*

Lawrence, Laurie Asher, F.R.C.S., 9 Upper Wimpole St., W. Surgeon in charge of Throat and Ear Department, Western General Dispensary.

LEE, CHARLES GEORGE, M.R.C.S., L.R.C.P., 11 Princes Avenue, Liverpool. Honorary Surgeon to the Liverpool Eye and Ear Hospital, Aural Surgeon to the Royal Southern Hospital. *Elected May* 2, 1903.

LITTLE, ANDREW, M.B., C.M.(Aberd.), 114 Manningham Lane, Bradford. Surgeon to the Eye and Ear Hospital, Bradford. *Elected December* 1, 1902.

LOVE, JAMES KERR, M.D.(Glasg.), Olrig, Newark Drive, Pollokshields, Glasgow. Aural Surgeon to the Royal Infirmary, Glasgow, Honorary Aurist to the Glasgow Institute for Deaf and Dumb, Lecturer on Aural Surgery, St. Mungo's College, Glasgow. *Elected February* 3, 1902.

McBride, Peter, M.D., F.R.S.(Ed.), 16 Chester St., Edinburgh. Aural Surgeon and Laryngologist to the Royal Infirmary, Edinburgh, Lecturer on Diseases of the Ear, Nose, and Throat at the University of Edinburgh. *C. V.P.*

MCCALL, ANTHONY, M.D.(Glasg)., Boscombe Court, Bournemouth. Surgeon to the Throat, Nose, and Ear Department Royal Boscombe and West Hants Hospital. *Elected December* 1, 1902.

MCKEOWN, WILLIAM ALEXANDER, M.D.(R.U.I.), 20 College Square, East Belfast. Surgeon to the Ulster Eye, Ear, and Throat Hospital, Lecturer in Otology at Queen's College, Belfast. *Elected February* 3, 1902.

MANNING, LESLIE SAMUEL, M.B., C.M.(Aberd.), Christchurch, New Zealand. Aural Surgeon to Christchurch Hospital. *Elected December* 2, 1901.

MASINA, H. M., F.R.C.S., Grant Medical College, Bombay, India. *Elected February* 3, 1902.

Matheson, Farquhar, M.B., C.M.(Aberd.), 11 Soho Square, W. Surgeon to the Royal Ear Hospital.

C *Milligan, William*, M.D., C.M.(Aberd.), 12 St. John St., Deansgate, Manchester. Lecturer on Diseases of Ear at Owens College, Manchester, Honorary Surgeon to the Manchester Ear Hospital, Aural Surgeon to the Manchester Royal Infirmary. *S.*

MOLE, HAROLD FREDERICK, F.R.C.S., 1 Tottenham Place, Clifton. Surgeon in charge of the Aural Department Bristol Royal Infirmary. *Elected February* 2, 1903.

MURRAY, GEORGE, M.R.C.S., L.R.C.P., 2 Harley St., W. *Elected December* 1, 1902.

NELSON, JOSEPH, M.D., L.R.C.S.(R.U.I.), 20 Wellington Place, Belfast. Aural Surgeon to the Royal Victoria Hospital, Belfast. *Elected March* 7, 1904.

NICOLL, JAMES HENDERSON, M.B., F.F.P.S.(Glasgow), 4 Woodside Place, Glasgow, Consulting Surgeon to the Glasgow Ear Hospital. *Elected March* 7, 1904.

NOURSE, WILLIAM JOHN CHICHELE, F.R.C.S.(Ed.), Abchurch House, Sherborne Lane, E.C. Assistant Surgeon to the Central London Throat and Ear Hospital. *Elected December* 2, 1901.

Paget, Stephen, F.R.C.S., 70 Harley St., W. Aural Surgeon to the Middlesex Hospital. *C.*

PARKER, CHARLES ARTHUR, F.R.C.S.(Ed.), 141 Harley St., W. Surgeon to the Throat Hospital, Golden Sq. *Elected February* 3, 1902.

PATERSON, DONALD ROSE, M.D.(Ed.), M.R.C.P.(Lond.), 18 Windsor Place, Cardiff. *Elected March* 5, 1900.

Pegler, Louis Hemington, M.D.(Ed.), 2 Henrietta St., W. Surgeon to the Metropolitan Ear, Nose, and Throat Hospital.

PERMEWAN, WILLIAM, M.D., F.R.C.S., 7 Rodney St., Liverpool. Surgeon to the Throat and Ear Department, Southport Infirmary. *Elected December* 3, 1900.

PETERS, EDWIN ARTHUR, M.D., B.C.(Cantab.), 52 Wimpole St., W. Surgeon to the Throat and Ear Department, Bolingbroke Hospital. *Elected December* 1, 1902.

PINDER, THOMAS HENRY, M.R.C.S., Alexandra Road, Manchester. Surgeon to the Manchester Ear Hospital. *Elected February* 2, 1903.

Pollard, Bilton, M.B., B.S., F.R.C.S., 24 Harley St., W. Late Surgeon in charge of Aural Department University College Hospital.

POTTER, EDWARD FURNISS, M.D.(Brux.), M.R.C.P.(Lond.), M.R.C.S., 49 Queen Anne St., W. Surgeon to the London Throat Hospital. *Elected December* 3, 1900.

C *Pritchard, Urban,* M.D.(Ed.), F.R.C.S., 26 Wimpole St., W. Aural Surgeon to the King's College Hospital. Professor of Aural Surgery, King's College, Consulting Surgeon to the Royal Ear Hospital. *V.P. P.*

Purves, William Laidlaw, M.D.(Ed.), 20 Stratford Place, W. Aural Surgeon to Guy's Hospital.

Sandford, Arthur W., M.D.(R.U.I.), 13 St. Patrick's Pl., Cork. Lecturer in Ophthalmology and Otology at Queen's College, Cork, Surgeon to the Cork Ophthalmic and Aural Hospital. *C. V.P.*

SANTI, PHILIP ROBERT WILLIAM DE, F.R.C.S., 15 Stratford Place, W. Aural Surgeon to and Lecturer on Aural Surgery at the Westminster Hospital. *Elected December* 3, 1900.

Scatliff, John Milton Ellenborough, M.D.(Aberd.), 11 Charlotte St., Brighton. Hon. Surgeon to the Brighton, Hove, and Sussex Throat and Ear Hospital.

Sheild, Arthur Marmaduke, M.B., B.C.(Camb.), F.R.C.S., 4 Cavendish Place, W. Surgeon to the Throat Department St. George's Hospital, late Aural Surgeon to the Charing Cross Hospital.

SPICER, FREDERICK. M.D.(Dur.), 17 Wimpole St., W. Surgeon to the Metropolitan Ear, Nose, and Throat Hospital. *Elected March* 3, 1902.

Spicer, Scanes, M.D., B.Sc.(Lond.), 28 Welbeck St., W. Surgeon to the Throat Department and Lecturer on Diseases of Throat at the St. Mary's Hospital.

Stewart, William Robert Henry, F.R.C.S.(Ed.), 42 Devonshire St., W. Surgeon to the Throat and Ear Department Great Northern Central Hospital, Consulting Surgeon to the London Throat Hospital.

V.P *Story, John B.*, M.B., B.Ch.(Dub.), F.R.C.S.I., 6 Merrion Square North, Dublin, Ireland. Honorary Oculist and Aurist to the Claremont Institute for Deaf and Dumb. *C.*

SYME, WILLIAM SMITH, M.D.(Ed.), 3 Northbrook Terrace, Glasgow. Aural Surgeon to the Glasgow Ear Hospital. *Elected February* 1, 1904.

Thomson, St.Clair, M.D., M.R.C.P., F.R.C.S., 28 Queen Anne St., W. Physician to the Throat Hospital, Golden Square, Assistant Physician for Diseases of the Throat to the King's College Hospital.

THORNE, ATWOOD, M.B.(Lond.), M.R.C.S., 10, Nottingham Pl., W. Assistant Surgeon to the London Throat Hospital. *Elected December* 2, 1901.

S *Tilley, Herbert*, M.D., F.R.C.S., 89 Harley St., W. Surgeon to the Throat Hospital, Golden Square.

TOD, HUNTER FINLAY, M.A., M.B., B.C.(Cantab.), F.R.C.S., 7 Wimpole St., W. Assistant Aural Surgeon to the London Hospital, Surgeon Throat and Ear Department Paddington Green Children's Hospital. *Elected December* 1, 1902.

Turner, Arthur Logan, M.D., F.R.C.S.(Ed.), 27 Walker St., Edinburgh. Surgeon for diseases of the Throat and Ear Deaconess Hospital, Edinburgh, Assistant Surgeon to the Ear and Throat Department Royal Infirmary, Edinburgh.

C *Waggett, Ernest Blechynden,* M.A., M.B., B.C.(Cantab.), 45 Upper Brook St., W. Surgeon to the London Throat Hospital, Surgeon to the Throat and Ear Department Great Northern Central Hospital.

C *Walker, Henry Secker,* F.R.C.S., 45 Park Sq., Leeds. Assistant Ophthalmologist and Aural Surgeon to the General Infirmary, Leeds, Lecturer on Ophthalmology and Otology at the Yorkshire College, Leeds.

WATERHOUSE, HERBERT FURNIVAL, M.D.(Ed.), F.R.C.S., 81 Wimpole St., W. Surgeon in charge of Aural Department Charing Cross Hospital. *Elected February* 3, 1902.

WESTMACOTT, FREDERICK HIBBERT, F.R.C.S., 8 St. John St., Manchester. Honorary Aural Surgeon to the Manchester Children's Hospital, Pendlebury. *Elected March* 4, 1901.

WHITEHEAD, ARTHUR LONGLEY, M.B., B.S.(Lond.), 3 Park Square, Leeds. Honorary Ophthalmic and Aural Surgeon to the General Infirmary, Leeds. *Elected December* 3, 1903.

Williams, Patrick Watson, M.D., 1 Victoria Sq., Clifton, Bristol. Physician to the Throat Department Bristol Royal Infirmary, Honorary Physician to the Deaf and Dumb Institute.

WINGRAVE, VITRUVIUS HAROLD WYATT, M.D.(Dur.), 11 Devonshire St., W. Physician to the Central London Throat and Ear Hospital. *Elected December* 2, 1901.

WOOD, CYRIL GEORGE RUSS, F.R.C.S., Hardwicke House, Shrewsbury. Surgeon to the Eye, Ear, and Throat Hospital, Shrewsbury. *Elected February* 2, 1903.

Woods, Robert Henry, B.A., M.D.(T.C.D.), 39 Merrion Sq. East, Dublin. Surgeon to the Throat, Nose, and Ear Department, Richmond, etc., Hospitals, Dublin.

C *Yearsley, Percival Macleod,* F.R.C.S., 10 Upper Wimpole St., W. Surgeon to the Royal Ear Hospital.

RULES AND REGULATIONS.

I.—*Name of the Society.*

The Society shall be called "The Otological Society of the United Kingdom."

II.—*Objects of the Society.*

The objects of the Society shall be:

(*a*) The exhibition and demonstration of patients, models, drawings, and specimens (microscopical or otherwise), illustrating the Anatomy, Physiology, Pathology, and Therapeutics of the Ear.

(*b*) The reading of papers and the discussion of questions in Otology, previously approved by the Council.

(*c*) The investigation by Committees:

(i) Of matters of public importance relating to Otology.

(ii) Of new methods of investigation or treatment of the diseases of the ear.

III.—*Constitution of the Society.*

The Society shall consist of Ordinary and Honorary Members.

The Officers of the Society shall be elected from among the Ordinary Members, and shall consist of a President, not less than two, and not more than four, Vice-Presidents, a Treasurer, a Librarian, an Editor of the 'Transactions,' and two Secretaries, who, with six other Members, shall constitute the Council. At least one fourth of the Council shall consist of Members not resident in London.

IV.—*Election of Members.*

Candidates shall be proposed on a form provided for the purpose, and signed by at least three Members from personal knowledge, who shall state the grounds of their recommendation, which shall be, either

(*a*) Contributions to Otology.

(*b*) The charge of an Aural Clinic approved by the Council.

(*c*) Professional eminence.

The names of those proposed as new Members shall, in the first instance, be submitted to the Council, with whom the power shall rest of declining to allow the nomination to proceed.

The proposal paper shall be read at one ordinary meeting, and the ballot shall be taken at the next meeting.

No election shall take place unless ten Members vote; one black ball in five shall exclude.

V.—*Form of Admission by the Chairman.*

Members shall be admitted personally by the following form, after signing their names in the admission book, and thereby agreeing to abide by the rules of the Society, and paying their admission fee and first annual subscription.

Form of Admission.—"By the Authority and in the name of the Otological Society of the United Kingdom, I admit you a Member thereof."

VI.—*Honorary Members.*

The Council shall have the power of electing men of distinguished eminence in Otology as Honorary Members. The number of Honorary Members shall not exceed six.

VII.—*Expulsion of Members.*

The Council shall have the power of expelling from the Society any Member whose conduct or mode of practice is considered unworthy of the Society. Notice of the Council's intention to expel him shall be sent in writing to the address in the Society's books, and he may appeal to the Society, whose vote, under Rule 8, shall be final.

VIII.—*Appeal.*

A Member who appeals against the decision of the Council, under Rule 7, can be finally expelled only at a General Meeting especially called for that purpose, and of which a written notice shall have been sent to every Member at least fourteen days previously. At least twenty votes must be accorded, and four fifths shall carry the expulsion.

IX.—*Subscriptions.*

There shall be an Admission Fee of One Guinea.

The Annual Subscription shall be One Guinea, payable to the Treasurer in advance at the date of the Annual General Meeting. Any Member whose subscription is six months in arrear shall be reminded of the same by the Treasurer, and if it be not paid within the current year he shall again be reminded by the Treasurer, and if he fails to pay his subscription, his name may be removed by the Council from the list of Members.

X.—*The Election of Officers and Council.*

(*a*) All the Ordinary Members shall be summoned by letter to the Annual Meeting in December, notice being given a fortnight beforehand, and the hour of meeting being stated.

(*b*) The President, Vice-Presidents, Treasurer, Librarian, Editor, Secretaries, and Council shall be elected by ballot at each Annual Meeting, and shall commence their duties on the day following election.

(*c*) One third of the Ordinary Members of the Council shall be replaced in rotation at each Annual Meeting by an equal number of Ordinary Members chosen from the Society at large.

(*d*) Balloting lists of the members recommended by the Council to fill the vacant offices shall be prepared by the Secretaries, and forwarded, together with the summons to the Annual Meeting, to every Ordinary Member of the Society.

(*e*) Two Scrutineers, appointed by the President at the commencement of the Annual Meeting, shall receive the balloting lists during the first hour, at the end of which they shall report the result to the meeting.

(*f*) In the event of equality of suffrage the President shall determine by lot.

(*g*) If a Member wishes to propose for ballot any candidate for office other than those whose names stand upon the list recommended by the Council, the name of such candidate, duly proposed by one Member and seconded by two other Members, shall be sent to the Senior Secretary at least a week before the Annual General Meeting.

(*h*) The Council shall have the power of filling up any vacancies which may occur in any of the offices of the Society between one Annual Meeting and another.

XI.—*The President and Vice-Presidents.*

The President shall regulate all the proceedings of the Society and Council, state and put questions, interpret the application of the rules and regulations, and decide every doubtful point. He shall sign the minutes of General and Council Meetings.

In the absence of the President, one of the Vice-Presidents, Treasurer, or some Member chosen by the meeting, shall perform his duties. The President and Vice-Presidents shall not serve for more than two consecutive years.

Every third President shall, if practicable, be resident out of London.

XII.—*The Secretaries.*

There shall be a Senior and a Junior Secretary elected for each session. The Senior shall retire at the end of each session, and shall, if the Society approve, be succeeded by the Junior. The Secretaries shall have the management of the correspondence of the Society and Council. They shall attend meetings. They shall take minutes, which they shall read at the following meeting. They shall notify to new members their election. They shall have charge of, and keep a register of, all papers communicated.

One of the Secretaries shall, if practicable, be resident out of London.

XIII.—*The Treasurer.*

The Treasurer shall receive all moneys due to the Society, and make up all payments ordered by the Council, keeping an account of all such receipts and payments. He shall keep a printed receipt-book for subscriptions, and every receipt and cheque shall be signed by him. He shall submit to the Council a written Report of the financial state of the Society, for presentation to the Annual General Meeting. All moneys shall be banked in the name of the Society. The Treasurer shall not hold office for more than five consecutive years.

XIV.—*The Librarian.*

The Librarian shall not hold office for more than five consecutive years.

XV.—*The Editor of the 'Transactions.'*

The Editor of the 'Transactions' shall not hold office for more than five consecutive years.

XVI.—*The Council.*

The Council shall have the management of the affairs of the Society. They shall meet as required during the session of the Society. Notice of the hour of meeting shall be transmitted by the Secretaries to each Member. Four shall form a quorum, and six shall form a quorum when the question of the expulsion of a Member has to be considered. The President, or any three Members, may call a special meeting.

They shall determine questions by vote, or by ballot if demanded, the Chairman having the casting vote. They shall call a special meeting or meetings after the close of the session to determine what communications and illustrations shall be published in the 'Transactions'; they shall make such regulations and issue such orders as shall appear to them conducive to the good government of the Society and to the proper management of its affairs, subject to the Rules of the Society. They shall appoint Investigating Committees as may be required.

XVII.—*The Society's Transactions.*

The Transactions of the Society, under the designation 'Transactions of the Otological Society of the United Kingdom,' shall be published in such manner as the Council may direct. The 'Transactions' shall be presented to all Members of the Society who have paid their annual subscription. No Member whose entrance fee or subscription is in arrear shall be presented with the 'Transactions.' The Council shall be empowered to present, in the name of the Society, copies of the 'Transactions' to such scientific bodies as they may think fit.

XVIII.—*Investigating Committees.*

The Council shall, as occasion demands, appoint Committees of Members of the Society, and, if desirable, one or more non-Members, for the purpose of investigating questions of importance in Otological science, and shall have authority to grant such sums

of money as they may deem necessary for the expense of these investigations. The Reports of such Committees shall be presented to the Council to be dealt with as they may deem most advisable. Such Committees shall be called "Investigating Committees": they shall consist of not less than three Members. The Investigating Committees shall continue to act until they have reported on the subject referred to them, or been dissolved by the Council. Every Member who has acted on an Investigating Committee shall sign the final Report, or shall state in writing his reason for declining to do so.

The Report shall be first received and considered by the Council, which may be specially summoned for that purpose, and shall afterwards, with their sanction, be presented at an Ordinary Meeting of the Society.

The Council shall be informed by their Secretary of the retirement of any Member of an Investigating Committee, in which case the Council may at their discretion appoint another Member of the Society to fill the vacancy.

The Investigating Committees shall render to the Council an account of all money received by them for the purpose of their investigations.

The Council shall have the power to dissolve an Investigating Committee whenever they may deem it expedient.

XIX.—*Ordinary Meetings.*

(*a*) The Ordinary Meetings of the Society shall be held on the first Monday, or some other day selected by the Council, at 4.30 p.m., in December, February, March, and May, in London or elsewhere, as the Council may decide.

(*b*) Each Member of the Society shall have the privilege of introducing a visitor at every Ordinary Meeting, on entering his visitor's name in the attendance-book; but no visitor shall be introduced more than twice in the same session.

(*c*) The business of the Society at the Ordinary Meetings shall be:

(i) The reading of papers and report of cases.
(ii) The demonstration of cases.
(iii) The exhibition and examination of specimens (microscopical or otherwise), drawings, instruments, models, methods of treatment, and the discussion of Otological subjects.

(*d*) At the Ordinary Meetings of the Society nothing relating to its laws or management shall be brought forward.

(*e*) At Ordinary Meetings ten Members shall form a quorum.

(*f*) Additional Ordinary Meetings shall be held if the Council think them necessary.

(*g*) Papers (which must be written in form fit for printing) shall not, as a rule, be of such length as to occupy more than fifteen minutes in delivery. An abstract of each communication, for publication in the Medical Journals, shall be given to the Secretaries before the end of the Meeting at which the communication is read.

(*h*) Members wishing to read papers previously approved by the Council, or show cases, specimens, etc., shall, if possible, give notice thereof to the Secretaries ten days before the meeting.

(*i*) All papers shall be handed to the Secretaries immediately after being read.

(*j*) In any discussion, each Member taking part shall write on a form provided for the purpose an abstract of his remarks, which shall be given to the Secretaries before the end of the meeting.

XX.—*The Annual General and Special Meetings.*

The Annual General Meeting of the Society, for the election of the officers and other Members of the Council, shall be held in December. All proposals to enact, alter, or repeal rules shall be proposed by the Council only at the Annual or Special Meeting of the Society, notice of all such proposals being transmitted to every Member, together with the summons to the Annual or Special Meeting. For the adoption of rules or changes so proposed, the votes of two thirds of the Members present must be in favour of the proposal.

Any Member of the Society may suggest to the Council alterations in the rules, by letter addressed to the Secretaries.

A Special General Meeting may be called at any time by the Council, or at the written request of any ten Members giving at least fourteen days' notice by letter to every Member of the Society resident in the United Kingdom, of the time of meeting and the business upon which it is summoned, and no business shall be entered upon at such meeting except that which has been notified.

XXI.—*Library Regulations.*

(*a*) The Library shall be open at the same hours as that of the Medical Society—viz., from 1 p.m. to 6 p.m. daily, except on Saturdays, when it will be closed at 3 p.m.

(*b*) Members may obtain books at 11, Chandos Street between those hours on signing a book provided for that purpose. But any books or periodicals may be placed by the Council on a separate list, such books not being allowed to be removed from the Library.

(*c*) A book must be returned at the expiration of a fortnight if wanted by any other Member. The Librarian will in such a case write to the Member in whose name the book was taken out.

(*d*) If the book be not returned within four days of such notice, a fine of 6d. will be charged for each day that the book is retained beyond such days of grace.

(*e*) Members resident in the country can obtain books by writing to the resident Librarian and transmitting the cost of postage. Such books are sent at the borrower's risk.

(*f*) A Member taking out a book will be held responsible for its being returned in good condition.

ANNUAL REPORT OF COUNCIL, 1902–1903.

PRESENTED AT THE ANNUAL MEETING, DECEMBER 7, 1903.

THE Council, in presenting their Annual Report, have pleasure in referring to the useful work done by the Society during the past session, and desire to tender their thanks to all who have contributed to its proceedings.

In addition to the Annual Meeting, four Ordinary Meetings have been held. The Council have met on six occasions. The extra-Metropolitan Meeting was held in Liverpool, and the Council desire to record their indebtedness to the Council of the Liverpool Medical Institution, and to Mr. Hugh E. Jones, to whose organisation the success of the extra-Metropolitan Meeting was largely due.

In the earlier part of the session an important discussion was held on "Tuberculosis of the Ear," which was introduced by Dr. William Milligan, Dr Jobson Horne, and Dr. Wyatt Wingrave.

A joint meeting, with our President in the chair, was held with the National Association of Teachers of the Deaf, during the Biennial Conference of the latter in London last July, when a discussion was opened by Dr. J. Kerr Love and Dr. William Permewan on "The Method of Dealing with and Developing the Residual Hearing Power and Speech of the Deaf." The discussion, it is believed, will be conducive to the dispelling of popular fallacies and to the establishment of the subject on a scientific basis.

The Council have appointed a Pathological Committee, to which Dr. F. W. Andrewes and Mr. S. G. Shattock have acted as referees, and special thanks are due to these gentlemen for their assistance in elucidating obscure diseases brought before the Society.

During the session 1902–03 thirteen new Members have been elected and four Members have resigned.

FINANCIAL STATEMENT OF THE HONORARY TREASURER.

THE Balance Sheet shows that the total income of the Society during the past session has been £169 14*s.* 7*d.* and the expenditure

£112 5*s.* 9*d.*, leaving a balance of £57 8*s.* 10*d.* After deducting from the latter the cost of printing the volume of 'Transactions,' £46 19*s.*, there will be a balance of £10 9*s.* 10*d.* to be carried forward.

Honorary Librarian's Report.

An exchange has been effected with the new *Centralblatt für Ohrenheilkunde,* edited by Dr. O. Brieger and Dr. G. Gradenigo, so that this publication is complete from its commencement in the Library. The other exchanges have continued as usual.

Several of the more important journals are being suitably bound.

It is a matter for regret that the Library is not more used by members, who are again reminded that books and pamphlets may be taken out on application by letter or personally to the Resident Librarian, 11, Chandos Street, W. They are also urged to send to the Library copies of any otological works they may publish.

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FOURTEENTH ORDINARY MEETING.

Monday, December 7th, 1903.

The PRESIDENT, Dr. URBAN PRITCHARD, IN THE CHAIR.

THE following report of the Pathological Committee was presented and adopted:

GENTLEMEN,—Your Committee beg to report upon the three microscopic sections referred to them on March 2, 1903, as follows:

Two slides marked "Mary R——" and "Mrs. B——" have been submitted to the Referees—Dr. Andrewes and Mr. Shattock,—and their report is appended.

The third section, marked "A——" and stated to have been stripped off from the bone covering the external semicircular canal, shows areas of caseation and fuchsin-staining bacilli which are indistinguishable from those of tubercle.

ARTHUR H. CHEATLE.
C. H. FAGGE.
WYATT WINGRAVE.
W. JOBSON HORNE.

October 12, 1903.

Histological Report upon Two Growths removed from the External Auditory Meatus.

By THE REFEREES.

CASE 1 (Mrs. B——).—This growth has in general the histological characters of the innocent tumours met with in the salivary glands, palate, lip, and elsewhere, and we should classify it in the same group of new formations now usually designated endotheliomata. This similarity renders a full and minute description of it unnecessary.

We find no cartilage in the stroma, which consists throughout of connective tissue including small areas of hyaline material. The other element takes the form of winding columns of polymorphous cells, only the very finest of which are devoid of lumen. Elsewhere the lumen is so pronounced in many spots as to produce a microcystic condition.

In the larger clusters of cells the cavities are not rarely multiple. The multiple spaces have a two-fold origin. Some are due to the formation of multiple lumina of the same kind as those appearing singly in the cross-sections of the smaller string of cells; but besides this the appearance results also from the enclosure of areas of the hyaline stroma by the extension of the cell-masses around them. This is obvious partly from the presence of similar somewhat circular areas of hyaline material in the stroma, but essentially from the circumstance that at the margin of such compound clusters hyaline foci of the stroma may be traced in process of inclusion. The ultimate results of the two processes are hardly distinguishable, seeing that the spaces due to vacuolation also hold a hyaline or finely granular substance.

The cell-strings are traceable into spaces or canals in the tissue from which, to all appearance, they arise.

CASE 2 (Mary R——).—The histological appearances here bear a general resemblance to those in the preceding case. The plexus of cell-strings in the stroma, however, is much closer and less regular, and the absence of lumen, again, is conspicuous in the lesser groups and lines of cells.

Certain areas would, indeed, be indistinguishable from those of a carcinomatous growth, and we regard the tumour as belonging to a malignant type. Clinically its malignancy is evident from its local invasion of bone and its recurrence after operation. As indicative of this important difference we should adopt the terminology of plexiform sarcoma for the growth under consideration rather than that of endothelioma. For although the histological source of the two tumours may be identical, the structural differences and clinical course point to the propriety of applying a different terminology in the two cases.

The origin of the growths in a region so close to the parotid gland is suggestive of a relationship with the neoplasms arising in connection with the latter structure.

F. W. ANDREWES.
S. G. SHATTOCK.

May, 1903.

The microscopic sections were exhibited.

The clinical history of the case of "Mary R——" will be found in Vol. I, p. 30, and Vol. IV, p. 88; that of the case of "Mrs. B——" in Vol. IV, pp. 17—20, and of the section marked "A——" in Vol. II, p. 42, of the Society's "Transactions."

The following cases and specimens were exhibited:

Mr. CHARLES HEATH showed *A Case in which a Post-aural*

Mastoid Operation was performed to open the Mastoid for Acute Symptoms supervening on a Chronic Suppurative Otitis Media.

The antrum and aditus were opened from the back of the bony meatus and laid into the tympanum. The posterior third of the membrane was gone. The ossicles and remains of membrane were left, and the case was shown to illustrate the complete restoration of the membrane and hearing.

Mr. ARTHUR CHEATLE asked how the operation was performed. At present there was a cicatrix in the posterior third of the membrane, and also a membrane which was shutting off the antrum from the meatus. One always liked in such cases to see the antrum laid into the meatus, but at present there was a membrane between.

Dr. THOMAS BARR asked by what method Mr. Heath opened the antrum.

The PRESIDENT said the operation was practically a Stacke.

Mr. HEATH, in reply, said in this case, in which there had been restoration of membrane, the antrum and aditus were opened up in the same way as in the other complete mastoid cases, namely through the bony meatus; the only difference in the operation was that the middle ear was not emptied of its contents. The ear was turned forwards and the cartilaginous meatus removed from its posterior attachment, and the whole of the posterior wall of the meatus was removed into the antrum, and the aditus opened up in the same way as in the other patients. The replacement of membrane was due to granulation tissue. The operation was not described as a complete mastoid operation. This case was also shown as an example of complete restoration of hearing.

Mr. CHARLES HEATH showed *A Series of Cases in which Complete Mastoid Operations had been performed.*

Dr. KERR LOVE said he supposed the cases were examples of the complete mastoid operation. Two or three of the cases were still discharging, and he believed none of them had been grafted. He wished to ask why Mr. Heath did not graft them. He did not think grafting was necessary in all such cases. Some of the cases appeared to have healed in a comparatively short time, and he asked what was the shortest time of healing without grafting. In his (Dr. Love's) experience the essential point was to have the bony wound of the proper shape, so that it could be easily reached at all times after the operation was finished, during the subsequent dressings. The second necessity was to have the meatal flaps so that they could be applied in a way to give the largest and best

shape of wound for subsequent dressing. Thirdly, there should be a removal of all necrosed or carious bone, and that was the condition least under the control of the operator. It was where carious bone had to be left that failure or great delay in healing occurred, and grafting in such cases did not get over the difficulty. Where no caseous material was left, healing took place in a reasonable time without grafting. He would like Mr. Heath's series of cases to be made the text on which to discuss the advantages of grafting after the mastoid operation.

Mr. MACLEOD YEARSLEY asked what Dr. Love meant by "reasonable time," which was a somewhat elastic term. He (Mr. Yearsley) regarded the cases as examples of Stacke's operation; that is to say, removal of the attic wall and working back into the antrum. Therefore they could not be regarded as instances of the complete mastoid operation, by which he understood a combination of the Schwartze and Stacke operations.

Dr. WILLIAM MILLIGAN did not think any one would say that grafting was essential, but they would agree that it expedited the process of repair very materially and minimised the trouble in the conduct of the case. Another advantage of grafting was that one could by that means immediately seal the opening of the Eustachian tube. In several of the cases shown by Mr. Heath which were still suppurating there appeared to have been a reinfection through the Eustachian tube. The attic was cicatrised in many cases, and lined with epithelium, but there was a little muco-pus on the floor of the middle ear. The epithelialising process which had gone on had failed to cover the tympanic orifice of the Eustachian tube. If grafting had no other advantages, it had at any rate, when properly done, the great merit of sealing up at once the orifice of the Eustachian tube, and so closing one of the most important portals of infection.

Dr. DUNDAS GRANT considered Mr. Heath's cases were interesting examples of the application of a principle to which he thought had not been given the attention it deserved. One constantly found on operating in cases of chronic suppuration of the middle ear that the cortex and cells of the mastoid process had become almost eburnated, and that in many cases the bone might be left with advantage. He (Dr. Grant) had not had sufficient confidence in the idea to put it into practice in any considerable number of cases, for fear of leaving foci of disease; but Mr. Heath's cases gave one great encouragement to persevere in that direction. It was all very well to make as large a cavity as possible, but one must recognise that when a large cavity was left opening out from the

posterior wall of the meatus, it often served as a pocket in which *débris*, such as desquamated epidermis, collected, causing a feeling of discomfort and involving periodic scavenging of the part. He often wondered whether it would not have been as well if he had left the eburnated bone in place of a yawning abyss. Whatever the defects of the operation, he thought Mr. Heath was to be congratulated on the results all round. He recalled a case which he showed before the Society about a year ago, in which there was attic disease, and in which, after turning forward the auricle, he chiselled the outer wall of the attic and aditus and got into a cavity which was lined with a cholesteatomatous matrix. He felt justified in omitting to remove the outer part of the mastoid process, and the case did extremely well; but it was already epithelialised, and a condition akin to that caused by a graft was present. The disease seemed limited by the matrix. In that case he did very much the same as Mr. Heath had done, though he had left the remains of the membrane and the ossicles, with a very good functional result. Still, the functional result might have been as good if he had removed the membrane and ossicles as well, because when they are removed and the internal ear is otherwise sound, the result with regard to hearing is often most satisfactory, and sometimes better than before the operation.

Mr. Cresswell Baber said the Society was indebted to Mr. Heath for showing these cases, but as he had not seen the operation he could not express an opinion about it. As far as he understood, it appeared to be a modification of an operation, of which he had seen several lately, which consisted in performing a radical operation by chiselling away the posterior wall of the meatus. A start was made at the edge, instead of doing a Schwartze first and a radical operation afterwards. As Mr. Heath left the whole of the cortex, it would be difficult to transplant. It would be very important to hear from him the length of time his cases took to heal, especially in regard to the use of a tube instead of plugging.

Mr. H. E. Jones said he understood Mr. Heath to say that in his series he rarely or never met with mastoid cells in a chronic case. Of course if one were sure one had to deal with eburnated bone without cells, he could understand that a small cavity was an advantage; but how was one to know that there were no cells? In two recent cases on which he operated the bone appeared to resemble gruyere cheese, with large cells separated by compact bone, and each cell—and there were many—was filled with *débris*. The antrum was cut off from those cells, but the cells were there nevertheless, and encircled by dense bone. The second case had

been operated upon by a general surgeon about two years before, and it was sent to him because the suppuration continued. On exposing the bone and enlarging the opening, he found the kind of condition he had described, and it was necessary to remove practically the whole of the mastoid process before he could feel sure that the whole of the disease had been eradicated. In such cases, which were not so rare as Mr. Heath had suggested, something more than simply removing the anterior wall of the antrum was required.

Dr. Barr asked how Mr. Heath dealt with the meatal flap. If Mr. Heath neither sutured the flap nor packed the interior of the ear, it was difficult to understand how the flaps kept in proper position. Another point was the presence of moisture on the inner wall of the tympanum, seen in most of Mr. Heath's cases. Dr. Barr had experienced every now and again the same difficulty—namely, that while the upper parts, the attic, aditus and antrum, were dry and epithelialised, a certain amount of moisture persisted on the inner wall of the lower tympanic cavity. Was that moisture due to any persisting carious condition of the inner wall of the tympanum, such as behind the fenestra rotunda; or was it due to the extension of a catarrhal process from a permeable Eustachian tube? From whatever cause, it was in some cases a troublesome remnant of the disease for which the operation was undertaken.

Mr. A. L. Whitehead thought Mr. Heath had done an ordinary Stacke operation, working backwards, and he had been fortunate in having a series of cases in which there was little or no disease in the mastoid proper, so that he had no occasion to get into the mastoid. Mr. Heath's operation would not discover disease there, nor be adequate to deal with it; in such a case he would have had to make the "large abyss" mentioned by Dr. Dundas Grant. When there was disease in the mastoid the question of grafting after the complete removal of the disease was a very important one. In some cases upon which he had operated, where the bone disease was very extensive and bilateral following influenza, grafting was performed on one side and not on the other. The side which was grafted healed in three weeks, but the other did not heal for four months, though the extent of disease was equal on both sides. Undoubtedly in the case of a large cavity grafting materially shortened the process of repair. But if Mr. Heath dealt with such a small cavity in the bone, it was a nice point whether it was worth while turning the ear forward again and grafting. The whole point of the series of cases shown seemed to be that there appeared to have been very little disease.

Dr. JOBSON HORNE said the Society was much indebted for the series of cases. He did not know whether Mr. Heath meant he adopted that form of treatment in all his cases requiring a mastoid operation. It was difficult to lay down hard and fast rules in regard to any particular line of operation; each case had to be taken on its own merits. The amount of disease present would decide largely what one should do. He was anxious to know whether the operation now detailed by Mr. Heath was his settled plan.

Mr. ARTHUR CHEATLE wished to associate himself with Mr. Jones in regard to the mastoid operation. Any operation which did not permit inspection of the mastoid cells was to be deprecated. With regard to grafting, Mr. Ballance laid it down at the Liverpool Meeting that the only advantage of grafting was that it shortened the time of healing. Dr. Milligan had said he closed the Eustachian tube with his graft, but it was difficult to apply a graft over the mouth of that tube. If the mouth of the Eustachian tube were curetted, the resulting granulation tissue would shut that out as well as any graft. He asked what Mr. Heath used a drainage-tube for. His own practice was to turn a flap from the meatus and stitch it in position on the raw surface, leave off packing and everything else after the first week, and do the subsequent treatment from the meatus. Packing was not necessary.

Dr. HEMINGTON PEGLER raised the question whether allowing the Eustachian orifice to be closed by granulation-tissue formation or by graft would not act prejudicially to the chances of improving or restoring hearing after the complete post-aural operation. He had experienced a fair number of cases in which inflation by the Politzer bag some time after operation had greatly improved the function, and in one particular case restored normal hearing in the affected ear, though a repetition of the process was occasionally necessary. He was desirous of obtaining opinions as to how this result was brought about under the changed conditions.

Dr. HERBERT TILLEY said he had taken considerable interest in Mr. Heath's cases, which had been in the same hospital as that with which he himself was connected. A point worth noticing was that the incision behind the ear was out of sight; the wound was in an excellent position and seemed to heal extremely well. Of course, if the ordinary semicircular incision were carried backwards into the hair and brought forward again below, a great deal of it would be ultimately invisible. It was practically impossible to see the wound in Mr. Heath's cases after twelve months. That could not be said about the larger and more usual incision. With regard to Dr. Milligan's remarks, he would ask him in how many cases of

skin-grafting he had succeeded in closing over the Eustachian tube so securely that it had not burst out again in a month or two when the patient had a cold. He believed that was a not uncommon sequel in such cases. He had often noticed that patients with a little moisture issuing from the tympanic end of the Eustachian tube seemed to hear better than those which remained permanently dry. He would like Mr. Heath to give details of his after-treatment, which certainly was painless, whereas in the ordinary way in packing the removal of the first dressing, especially in children, was often very painful. Two days ago he (Dr. Herbert Tilley) operated by Mr. Heath's method on a child whose right ear had been suppurating since birth, the infection arising from septic complications in the mother; the case had done extremely well. Whatever might be said with regard to Mr. Heath's method as a whole, there were one or two features in the operation and after-treatment which seemed worthy of consideration, and which might usefully modify the steps of the ordinary complete mastoid operation as it is usually carried out.

Dr. Adolph Bronner said that every mastoid case was different, and the operation should be selected to suit the case. In some cases grafting was desirable, in others not. In some cases he used a drainage-tube, in some packing, and in others nothing at all.

Mr. Heath, in reply, said he did not graft, because he removed so little bone that there was a very small cavity to fill up, and that was the reason he adopted his present procedure. When doing the larger operation years ago it became necessary to fill up the hole, but he had given that up for the reasons explained. In reply to Mr. Yearsley, he did not think it was necessary to give it any particular name; he found it very useful, and adopted it in all cases where he was not obliged to do the larger operation. He had done fifty in the last six months, and had seen no reason to regret it. The hearing was very much better than members had had an opportunity of judging in the noise going on. Dr. Milligan had said that grafting was good. All were entitled to their opinions; he had given it up for the reason he had explained. If one blocked such a small cavity with a graft, one would scarcely be able to see the middle ear. It was true there was still moisture in some cases, but it could not be called pus. One of his principles was to leave the mucous membrane of the middle ear. He had to take away the ossicles, and there was a certain amount of curetting done to the attic, and that was one of the reasons the attic had the tendency to dry, whereas the lower part of the middle ear had not. Much curetting could not be done without impairing the

hearing power. In removing the ossicles the amount of curetting was limited by that removal; one of the great points of the operation was to retain the hearing. If the mucous membrane were curetted from the inner wall, it was likely to be replaced by scar tissue, and that would fix one or both fenestræ, the freedom of which was one of the vital principles in the operation. The average time of retention in hospital after the operation was about a week. The dressing was taken off on the day following operation, and a smaller one applied and the tube left in, the small piece of tissue in the attic being removed through the tube. In two days the posterior incision was healed, and all dressing was discontinued, a small piece of cotton wool being put in the concha in front to hide the tube. On the third day spirit drops were begun, the effect of which was to diminish the formation of granulation tissue. If there were much granulation tissue there was a discharge from it, and the granulations were apt to grow across from the ridge to the front wall. Often there was considerable ulceration before operation; he saw the cases once day, and the spirit drops were applied by the nurse. Granulation tissue was a great bugbear, and if it was excessive he removed it by means of fine forceps. This was hardly ever necessary. He regretted having no time to reply to all the questions, but had exhibited his cases as much to show the good hearing as the method of the operation.

Mr. Arthur H. Cheatle exhibited the following specimens:

1. *Right Temporal Bone from a Patient aged Fifty-four Years, showing Three Ivory Exostoses growing from the Vaginal Process.*

2. *Right Temporal Bone from a Patient aged Thirty-four Years, showing General Thickening of the Vaginal Process.*

Specimens 1 and 2 illustrated that exostoses and hyperostoses were due to changes in the tympanic portion and not in the squamous or mastoid portions. The same point was shown in the specimens among the collection of skulls in the Royal College of Surgeons' Museum.

3. *Single Pedunculated Exostosis removed from the Anterior Meatal Wall close to the Orifice in a Young Man.*

The pedicle was extremely thin and easily broken through. The specimen was sawn in half, the section passing through the pedicle.

4. *Single Pedunculated Exostosis removed from the Same Situation in a Middle-aged Man.*

The specimen was sectioned through the pedicle.

5. *Small Single Pedunculated Exostosis removed from the Same Situation in a Young Woman.*

6. *Right Adult Temporal Bone showing Marked "Lipping" and Thickening of Sutures and of the Posterior Border of the Mastoid Process, with Partial Bony Obliteration of the Round Window.*

Mr. HUNTER TOD showed a *Case of Rodent Ulcer involving the Left Auricle and the External Meatus in a Man aged Forty-nine Years.*

Eight years ago the patient first noticed a small wart, which soon became an ulcer, on the anterior margin of the lobule of the ear. As it caused no pain he did not seek treatment until two years ago, although the ulceration had spread considerably. He had been under treatment by the X rays for eighteen months before going to the London Hospital, but did not think there was much improvement. On admission to the hospital three months ago the ulceration involved the lower half of the auricle and the external meatus, to within one-third of an inch of the membrana tympani. The skin in front of the tragus, over the parotid region, was replaced by scar tissue, as if the ulcer had been more extensive, and had been partially healed by previous X-ray treatment. The patient was improving under treatment, with exception of the external meatus, where the ulceration seemed to be slowly advancing towards the membrana tympani.

Mr. LENTHAL CHEATLE said he had for some time been of opinion that rodent ulcer and squamous epithelioma were associated in incidence with the maximum points of Dr. Head. He had tried to point out that those rodent ulcers in spreading occupied certain definite areas when they got to a certain point, and he had all along believed that those areas were nerve-areas. He had shown that rodent ulcer did not spread in anæsthetic areas. He had a series of four cases which began on exactly the same point as in Mr. Tod's case, viz., the mandibular maximum point. They corresponded with Heiberg's conception of the distribution of the fifth nerve. He asked the Society's help in collecting records of cases of rodent ulcer and squamous epithelioma on the pinna, a region of very mixed nerve-supply, viz. pneumogastric, second and third cervical posterior spinal roots; also the fifth nerve.

Mr. TOD asked for advice as regards future treatment. Was it advisable to rely entirely on the X-ray treatment, or should one interfere surgically, so as to avoid the ulceration spreading to the middle ear?

Dr. HERBERT TILLEY considered that, as the ulceration was rapidly

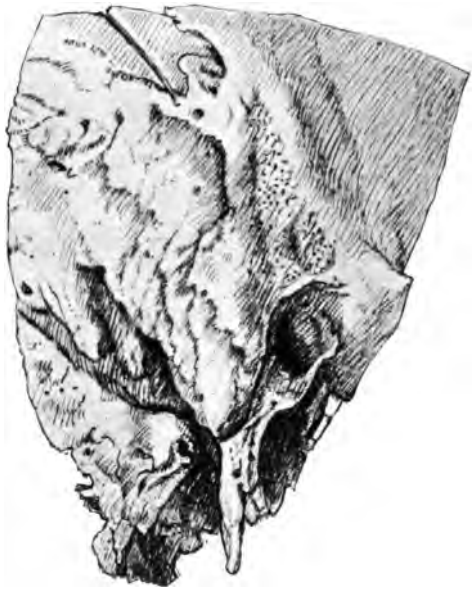

FIG. 1.—RIGHT ADULT TEMPORAL BONE SHOWING MARKED LIPPING AND THICKENING OF THE SUTURES AND MASTOID PROCESS.

FIG. 2.—THE SAME BONE SECTIONED THROUGH THE MIDDLE EAR SHOWING PARTIAL BONY OBLITERATION OF THE ROUND WINDOW.

Specimens exhibited by Mr. ARTHUR CHEATLE.

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approaching the membrane, it would be as well, if it were possible, to remove the disease, or part of it, surgically. Should there be recurrence at any spot, the light treatment could then be resorted to.

Dr. MACNAUGHTON-JONES said that the most successful treatment in cases of rodent ulcer elsewhere he had found to be the application of chloride of zinc paste. When the ulcer was shaved off the paste was then applied. This, if done in such a case as the present, if seen in its earlier stage, he believed would be effectual.

Mr. WHITEHEAD asked how long the case had been under treatment by the X rays, and what the amount of improvement had been.

Dr. JOBSON HORNE said it would be interesting to have a record of the present extent of the disease, by means of a photograph or coloured drawing for the "Transactions," because it was always interesting to see such cases some years hence.

Mr. ARTHUR CHEATLE thought the treatment of the case should be by X rays; and if by some such method as Dr. Tilley suggested the deeper parts could be brought within reach of the rays, so much the better.

Dr. MILLIGAN thought the case would be better treated surgically from the present moment. The disease was creeping towards the middle ear, and would soon invade it, and then the chance of recovery, even under the "light treatment," would be minimised. He would be disposed to remove as much of the diseased tissue with the knife as was possible, and, as Dr. Tilley suggested, if there were recurrence, to fall back on the "light treatment."

Mr. TOD, in reply, said that Dr. Sequeira, who had treated the patient by the X rays, thought he would be able to effect a cure; but he (Mr. Tod) would report to him the result of the discussion, and would operate if it was found that the X-rays treatment could not arrest the extension of the disease within the external meatus.

Dr. MACNAUGHTON-JONES showed *A Case of Unilateral Deafness from Childhood, due to Various Middle-ear Causes and Polypus.*

Dr. Macnaughton-Jones showed a patient, aged forty, with the following history:—She never remembered hearing with the right ear, and she and her friends were always under the impression that it was useless. The only affection from childhood from which she suffered was measles. As long as she could recollect she was troubled with pain in this ear periodically. This was occasionally relieved on the formation of abscesses, and these continued to recur until she was twenty-three. Then followed a purulent discharge, which continued on and off, in spite of treatment. Two years since a small polypoid growth was detected, but

nothing was done until September, 1902. Dr. Macnaughton-Jones then saw her, and removed a large pedunculated polypus, which filled the meatus. Beneath this was a mass of granulation tissue extending into the tympanum. This was curetted out. On a few subsequent occasions all remaining granulation tissue was scraped away with a fine curette, and trichloracetic acid was used subsequently. Treatment ceased about a year ago. It had consisted of applications of peroxide of hydrogen (10 vol.) and formic aldehyde. Lately she had come again in consequence of some slight moisture, but there was nothing purulent, and the tympanum was otherwise quite healthy. The attic was clear; the stapes remained, with portion of the malleus, and she could hear a low whisper with that ear at a distance of some feet.

Appearance of tympanum when shown. Light spot to the left in the illustration, over promontory, only unhealed portion.

Mr. Cresswell Baber asked what operative treatment was performed.

Dr. Macnaughton-Jones said, in reply, that the operative treatment consisted, as he had said, of the removal of a large polypus from the external meatus, at the bottom of which, and partly filling the tympanum, was the granulation tissue. This was curetted away completely. The principal interest of the case consisted in the fact that the patient had never been aware of any hearing in that ear. The operation was performed fifteen months since.

The President said it was not his intention to inflict a long speech on the members, but he could not leave the chair without thanking them for the kind manner in which they had supported him during his Presidency. He also thanked the officers, especially the Secretaries, for the way they had seconded his efforts during his two years of office.

Mr. Cumberbatch proposed a cordial vote of thanks to the President for the way he had fulfilled the duties, both official and social, appertaining to the position of President. He had held the office with great credit to himself and with benefit to the Members.

FIFTEENTH ORDINARY MEETING.

Monday, February 1st, 1904.

THE PRESIDENT, DR. THOMAS BARR, IN THE CHAIR.

The following gentlemen were elected ordinary members of the Society :—

GEORGE JACKSON, F.R.C.S.Eng. (Plymouth).
WILLIAM SMITH SYME, M.D.Edin. (Glasgow).

The PRESIDENT read his Introductory Address as follows:

GENTLEMEN,—I beg first to tender you my most sincere thanks for the high honour you have conferred upon me in electing me as your President. I can assure you that, while conscious of the difficulty of coming after two such distinguished predecessors, it will be my earnest endeavour to maintain the high position which this Society has already achieved. Residing as I do so far from the Metropolis, I shall not have the advantage, enjoyed by the previous occupants of the Chair, of being in constant personal touch with the office-bearers and members in London. With your kindly forbearance, however, and the support and guidance of my good friends the Secretaries I hope this disadvantage will not prove a hindrance to the work of the Society, and that we shall go on "Still achieving, still pursuing."

The published "Transactions" bear witness to the amount and excellence of the work done during these four sessions, and the Society has undoubtedly amply fulfilled its *raison d'être*. The remarkable development in the pathology, diagnosis, and operative treatment of purulent diseases of the ear and of their complications has of late years largely monopolised the thoughts and efforts of otologists, overshadowing, perhaps unduly, other departments of our subject. The improvements in the operative treatment of the middle-ear spaces, with which the names of Stacke, Küster, Schwartze, Ballance, and others have been identified, have gone hand in hand with the brilliant developments of otitic intra-cranial

surgery inaugurated in 1886 by Barker, Caird, and Macewen. It is not surprising therefore that the great bulk of the material brought before the Society has hitherto referred to these affections.

Of the 144 papers, demonstrations of cases, specimens, and discussions contained in these "Transactions," I find that eighty-six, or 60 per cent., relate to purulent diseases of the ear or their intracranial or intravascular complications. Another class not less frequently met with in practice is conspicuous by its absence from these "Transactions," namely, *the non-exudative or interstitial inflammations of the middle ear*—including the dry catarrhal and sclerotic groups,—affections which bulk so painfully in our daily practice.

While these have not the surgical interest of the purulent varieties, their great frequency, their intractable character, and their distressing concomitants render them well deserving our earnest attention. The lives of the sufferers may not be menaced as in the purulent cases, but their happiness, their usefulness, and their life prospects are profoundly affected by the loss of hearing and the distracting noises from which they usually suffer. These are the cases to which we so often apply all our experience, all our skill, and all our knowledge, with results which are frequently rather discouraging both to ourselves and our patients. Yet, when our efforts do prove partially successful, when the hearing is improved, when the harassing sounds are removed or diminished, the patient frequently exhibits keener feelings of gratitude than are evoked by the cure of a purulent discharge, the danger of which he rarely realises and consequently the cure of which he seldom adequately appreciates. We must all frankly admit that hitherto progress in the treatment of these cases has been unsatisfactory, compared with that of the purulent forms. The question is, can we as a Society do anything to expedite this progress and to remove the burden of the reproach under which we lie in connection with the treatment of these affections? Can we by investigation and discussion, conducted on the definite scientific lines laid down by this Society, help to define more clearly the true value of present methods of treatment, or happily devise new and improved ones? For example, what are the true value and limitations of inflation of the middle ear in this class of cases, of applications to the tympanic cavity through the Eustachian catheter, of the Eustachian bougie, of electrolysis of the Eustachian tube, of so-called air-massage of the tympanum, of intra-nasal treatment, of high frequency electric currents now being tried? Might we not discuss with advantage the true position of the operative treatment

of these cases? How do we stand in regard to cutting operations on the tympanic membrane or on the intra-tympanic structures? Has the proposal to open the labyrinth by perforating the inner tympanic wall borne any fruit; or has the attempt to deal surgically with the intra-tympanic and intra-labyrinthine contents by way of the radical mastoid operation led to any satisfactory result? You may remember that at our meeting in May, 1901, high expectations were aroused by a case in which the grafting of a cavity in the labyrinth seemed to have strikingly improved the hearing, and several speakers expressed the opinion, based on this case, that a new era had begun in regard to the treatment of the dry forms of deafness. I fear, however, that subsequent silence on this matter has been ominous of unfulfilled hopes. If operative treatment has so far not been conspicuously successful in improving the hearing in these cases, may we yet hope to relieve by such means the subjective sounds which so often spoil the patient's life? A man recently presented himself harassed with violent throbbing in his left ear, heard by auscultation as a distinct bruit and entirely stopped by pressure behind the mastoid and over the carotid. As he heard better when the pulsation ceased, he was in the habit, when listening to anyone, of pressing with his finger upon the spot behind the mastoid. How clear seemed the indications here for operative treatment, and with confident expectation the external carotid artery was ligatured by a general surgeon. With the return of consciousness returned the harassing pulsating sound, and he was again able to stop it by pressure even through the bandages. A second operation was performed in which the vessel situated underneath the spot upon which pressure relieved the pulsation, probably the posterior auricular artery, was ligatured, with unfortunately a similarly negative result, and the patient returned to his home with his throbbing tinnitus unrelieved. Again, a man suffered for years from left-sided deafness, loud whistling tinnitus, and latterly such violent giddiness and staggering as to utterly unfit him for work. All ordinary methods of treatment had been tried without appreciable effect, and at last he was advised to have his auditory nerve severed at the internal auditory meatus. This, which also involved the cutting of the facial nerve, was carried out by one of our Glasgow surgeons in a protracted operation. The effects were disappointing, the giddiness for a few days as he lay in bed was worse than ever; at present, nearly two years afterwards, the tinnitus and staggering remain pretty much as before, with the addition of absolute deafness on the side affected, as well as facial paralysis. Such failures suggest problems for investiga-

tion by this Society. In regard to the first case, may we not hope that with fuller investigation into the collateral circulation of the ear and of the actual seat of pulsating tinnitus we may yet be able to ligature in such cases with greater success? With respect to the second case, may further investigation enable us yet to discriminate a labyrinthine source of symptoms from an intra-cranial one? A monument surely awaits the man who finds an effective remedy, surgical or medical, for the hitherto incurable forms of tinnitus.

There is a very practical question in which the interchange of views by members of this Society would be very helpful in these forms of deafness, namely, the duration of treatment and the frequency of the visits of patients for treatment. This is a point upon which very different opinions and practice prevail. Some otologists are content with seeing the patient only once or twice, prescribing the use of Politzer's bag and the inhalation of sal-ammoniac vapour, and writing a letter to the family doctor expressing a very cautious, if not gloomy, prognosis. There are others, equally conscientious, who in such a case would see the patient daily or every second day for weeks, would regularly inject solutions through the Eustachian tube into the tympanum, would at frequent intervals employ so-called air-massage of the tympanum, would operate upon or cauterise the intra-nasal spaces, if even a slight deviation from the ideal normal were visible, and, after the conclusion of such a course, he would advise a shorter course of treatment, to be repeated once or twice a year. Of these two methods, the tendency in this country is probably towards the former, while on the Continent the method by frequently recurring treatment seems to prevail; at least, cases not unfrequently come under my notice in Scotland of patients who, after having received in this country the limited treatment, have gone to otologists on the Continent, where they received treatment daily, sometimes twice a day, for weeks. In this country we have a natural disinclination to involve patients in troublesome and prolonged treatment when we feel that the result may not appear to be such as to compensate the patient for the time and money expended on the process. One sometimes hears such a remark as "It was very good of Dr. So-and-so to tell me at the first visit that nothing could be done for my hearing." But may we not sometimes err in dismissing the patient after a first examination as incurable, or in carrying out treatment in too limited or half-hearted a fashion? A young lady, whose father and two brothers are members of the medical profession, was under my care for

progressive deafness, which seemed to belong to the sclerotic variety of middle-ear disease. It pursued the usual unsatisfactory course of such cases, although I had the advantage of the co-operation of the lady's brother, who had an unusually good knowledge of ear disease. On the whole, as the years went on the hearing seemed to become appreciably worse. Hitherto the so-called air-massage of the tympanum had been practised with Delstanche's speculum from time to time, but not at short intervals. One of the patient's brothers thought he would try this method in a more thorough fashion, and fitted up an electro-motor in his consulting-room, with which the treatment was repeated daily for weeks, to the extent of a thousand strokes a minute, with apparently very gratifying results. I saw the lady a week or two ago, and there seemed to be distinct improvement, attributed by both brother and sister to the frequent use of this air-massage. I felt that sometimes we may err in adhering to too limited and over-cautious methods in the treatment of these cases, and it would be very interesting and instructive if the opportunity were provided by this Society for the discussion of such a matter.

There is one more question. May we look forward to the time when this Society shall possess a permanent and ever-enlarging anatomico-pathological museum, to which members might resort for leisurely inspection and study? We have a library to aid us in our studies. Would it not be as appropriate to have a museum in which not books but the facts of Nature might be studied in the original, each specimen being "as a book where men do read strange matters"? And, just as the library is frequently enriched with donations of books from various sources, might we not expect similar enrichment of our museum not only from members of this Society, but from sources outside of it, both at home and abroad? If every specimen placed in such a museum by members of this Society were to have attached to it a clinical history of the patient, or a reference to a published paper bearing upon the specimen, its value would be vastly increased. There might be included a museum of instruments bearing upon our specialty, to which members would be expected to contribute instruments devised by themselves. Amongst other advantages, such a collection of instruments might at times reveal to a member who meditates the introduction of a new instrument that his ideas had already taken a concrete form. When one recalls the museum, which was probably the great feature of the London Meeting of the International Otological Congress, one is impressed with the desirability of building up a permanent one in connection with this Society.

What a magnificent centre of attraction and instruction for the otologists of the United Kingdom!

Gentlemen, there never has been a time in the history of otology in this country when so many able, earnest, and scientific workers have been engaged in the investigation of its problems. Here we have in this Society over one hundred workers, many of them fired with the enthusiasm of youth, from whose earnest efforts we hopefully anticipate important results, which will have far-reaching and beneficent effects on the community.

Mr. C. H. Fagge communicated the *Notes of a Case of Acute Pneumococcal Otitis Media complicated by Facial Paralysis.*

J. B. M—, aged nineteen, consulted Mr. Fagge on March 23, 1903, on account of pain felt in the right ear on the previous morning, and which had been treated locally with opium. On March 23 the patient noticed deafness with pain in the jaw on the right side when eating. A watch was heard on contact on the right, and at thirty-six inches on the left.

The right membrane was obscured by wax, which was removed, and was then seen to be red with the epithelium sodden; the malleus was not seen on account of the swelling of the drum. The naso-pharynx showed a small flat mass of adenoids. He was Politzerised, which temporarily relieved the pain, and he was directed to instil glycerinum acidi carbolici.

On March 24 the pain had recurred, and though the signs of otitis media were locally less marked, there was complete infra-nuclear right facial paralysis. He was put to bed, and at ten p.m. the temperature was 102·6° F.

March 25.—Temperature 100° F.; pain present, but not marked. Paracentesis of the right membrane was done with antiseptic precautions under A.C.E. mixture. Pus was evacuated, which was unexpected, as the local appearance of the membrane did not suggest its presence; the pus gave a pure culture of pneumococcus.

After about a fortnight the facial paralysis began to improve, and the ear was dry and the perforation healed.

On May 12 the facial paralysis was well, except for slight weakness of the orbicularis palpebrarum; the hearing by the right ear was $\frac{36}{36}$; and under galvanism the palsy had entirely gone a few weeks later.

This case was communicated because of the early onset of paralysis in acute otitis media, pneumococcal in orgin, and in which there was certainly no suspicion or bacteriological evidence of tubercle, and further because of the very happy result which

attended paracentesis, though this unfortunately could not be carried out till the fourth day.

Mr. A. H. CHEATLE considered the case one of interest, and the result good. He supposed that the facial nerve was exposed from a natural absence of part of the bony canal.

Mr. C. H. FAGGE said Mr. Cheatle's theory of the causation of the palsy agreed with his own.

Mr. C. H. FAGGE exhibited a *Specimen of Mal-development of the External, Middle, and Internal Ears in a Still-born Infant.*

The specimen showed the two halves of the head of a newly-born infant, from the left half of which the temporal bone had been removed and macerated.

The left half of the head showed a small, blind, shallow depression in the position of the external auditory meatus, below which was a crescentic nodule of skin and soft parts without cartilage, representing the pinna.

The right half of the head showed an extensive macrostoma, the angle of the mouth extending nearly to the external auditory meatus, which was narrow, shallow, and blind, and situated well above and in front of the rudimentary pinna, which was much like that on the left.

The right temporal bone had been partly dissected from above, and showed a normal internal auditory meatus, from which the facial aqueduct could be traced to the position of the geniculate ganglion, but was there lost in the dissection carried downwards external to the course of the facial nerve; the superior and external bony semicircular canals had been exposed, and could be demonstrated to end below in a cavity, evidently an ill-developed vestibule; dissection in the bone there had failed to show any evidence of a middle ear or antrum, or any spiral canal of the cochlea.

The left temporal bone had been cleaned and macerated, in doing which it was divided into two halves—(1) squamous, (2) petro-mastoid;—there was no tympanic ring.

The petro-mastoid part, sectioned parallel with and three-sixteenths of an inch from the external surface, showed an outer surface with which clearly part of the squama was fused; this was irregular and slightly concave, but showed no external auditory meatus and no stylomastoid foramen. The cut surfaces of the bone showed the parts of several irregularly connected cavities, of which one, the lowest (? the rudimentary cochlea), had an opening

on the inferior surface of the bone; the external semicircular canal, which was large, opened into the upper and posterior part of this cavity, which perhaps represented the vestibule.

The inner half of the left petro-mastoid showed the facial aqueduct from the internal auditory meatus to the genu, where it comes to the surface and is lost; it also showed the usual elevation in the position of the superior semicircular canal, but neither this nor the right side showed any floccular fossa.

The soft palate completely blocked the naso-pharyngeal space, for the nasal cavity ended blindly behind, though the turbinate bodies were well formed; no Eustachian tubes, cartilaginous or bony, could be demonstrated on either side.

The President said it was a most rare form of malformation. The development of the labyrinth was so different in its origin from that of the middle and external ear that it would be very interesting to know the exact condition of the labyrinthine cavities in such a case of arrested development.

Dr. Herbert Tilley said a point in the case which interested him was that no antral cavity was present. At the Liverpool Meeting last May Dr. Paterson, of the Liverpool University, gave a most interesting paper and demonstration on the development of the ear, and it seemed possible from what he said that it might be one's experience to meet a patient with ear symptoms which seemed to necessitate an antral operation, and yet this cavity might be found to be either particularly small or absent. Just before that date he (Dr. Tilley) had operated upon a case in hospital in which he thought that practically no antrum existed. He got very deep in the ordinary mastoid operation, but came to no cavity. Then he approached it from the middle ear, and tried to find his way from the upper part of the tympanic region into an antrum through the "aditus ad antrum," but could only insert the point of the probe into a small depression which seemed to represent the antrum, and which was external to the deepest part of bone wound in the antrum. The patient was an adult, aged twenty-five, suffering very much pain, associated with chronic suppurative otorrhœa, symptoms which did not get well by any treatment through the external meatus. He recorded the history of the case at the Liverpool Meeting, and asked there the question which he repeated at the present meeting, namely, whether any one of the members present, in operating upon an adult, had found the antrum so small that it would justify them in surmising that possibly it might be even smaller, or practically non-existent? In

the present specimen, which was undeveloped, there was no antrum, nor anything to correspond with it.

Mr. FAGGE, in reply, said he was grateful for the encouraging remarks of the President, as, considering the rarity of the specimen, the absence of much discussion upon it was most disappointing. With reference to the internal ear, he found on the right side the superior semicircular canal normal; the facial and auditory nerves could be seen passing into the internal auditory meatus, but beyond that point he could not trace the facial nerve, and there was no stylo-mastoid foramen for its exit. With regard to the termination of the auditory nerve, there was no evidence of any cochlea, as far as he had yet carried the dissection. On the left side there was no evidence of any spiral canal of the cochlea; the section here opened into two halves a cavity which he imagined was derived from the original epiblastic diverticulum (otocyst), which should give rise to the internal ear, but which here showed no signs of differentiation. If the internal ear were really rudimentary, it was an exception to the usual rule, for Bezold and Joel (*Zeitschrift für Ohrenheilkunde,* xviii and xxvi) had in sixteen recorded cases of abnormal external ears with absent or defective tympana found the internal ear normal in ten cases. In answer to Dr. Tilley, he had heard Prof. Paterson's very interesting paper at Liverpool, and he thought the weak point in Dr. Tilley's argument was the presence of the tympanum. He (Mr. Fagge) would have said no middle ear no antrum, but where there was a middle ear that there must be an antrum, His specimen clearly indicated a want of development of the dorsal segment of the first visceral cleft, in both its internal and external clefts, and also of the adjacent cartilaginous bars, but he was quite unable to account for the abnormalities in the internal ear. Having shown the specimen, he proposed to decalcify and cut serial sections of one of the temporal bones, in order to definitely solve the questions he had been asked, but he had wished the Society to see and examine the specimen before it was much cut into.

Dr. WILLIAM MILLIGAN made a short communication upon *The Ætiology and Treatment of Labyrinthine Suppuration,* which was illustrated by lantern slides, and will be found on p. 25.

The PRESIDENT said he was sure all the members must feel, as he did, that the paper was a most interesting and instructive one, and upon a subject which had not hitherto received the attention it deserved. For bringing forward the facts so lucidly and impressively Dr. Milligan deserved the warmest thanks of the Society.

It was agreed that the discussion of the paper be postponed until the next meeting.

Mr. HUNTER TOD communicated a *Case of a Tumour of the Right External Meatus in a Woman aged sixty-seven, removed by Operation; Sarcoma.*

The patient, specimen, and microscopic section were shown.

The patient was first seen in October, 1903. She was extremely deaf in both ears. She had noticed a small growth in the right ear for three months.

The right external meatus was blocked by what appeared at first sight to be a broad-based papilloma, situated at the junction of the fibrous and osseous portions of the posterior wall of the auditory canal. It was about the size of a large pea, and was limited to the external meatus. A portion removed by the snare and examined microscopically showed the structure of a round-celled sarcoma.

The following week the growth was removed. A post-auricular incision was made, and the auricle turned forwards. The external meatus was completely excised. Although the bone appeared normal, the posterior wall of the bony meatus was chiselled away as far back as to just expose the antrum, and inwards as close to the membrana tympani as possible without injuring it. The skin wound was sutured, and the cavity was packed through the external meatus. Six weeks later the cavity was skin-grafted through the external meatus. The cavity was now covered with skin, with the exception of a small area over the region of the antrum, and there was no stenosis of the auditory canal. The deafness was not improved, the patient apparently had been suffering from chronic middle-ear catarrh for some years.

Mr. Tod asked that the section might be submitted to the Pathological Committee, to consider the diagnosis of sarcoma; for if it were a round-celled sarcoma, it would be a case of great rarity.

It was agreed to submit the specimen to the Pathological Committee of the Society.

Dr. W. H. KELSON showed a *Case of Deafness with Adventitious Membrane of Meatus following Chronic Suppuration of the Middle Ear.*

The patient was a girl aged twenty who had suffered from a discharge of pus from the right ear when a child. She was very deaf on that side, and was anxious to regain her hearing, if possible. On examination the ear was found to be quite dry, but there was a

red membrane with a whitish spot near its centre stretched across the right auditory meatus. No ossicles were visible; the membrane was considered not to be the membrana tympani because it was markedly nearer to the entrance of the meatus than the drum was on the other side. Bone conduction was much better than aërial; inflation did not improve the hearing.

Mr. CRESSWELL BABER suggested that there should be no radical treatment in that case, as there did not seem to be much discharge. He would treat it in the ordinary way by means of astringents or drops of alcohol.

Dr. PRITCHARD asked what was the condition of the hearing on the other side.

Dr. KELSON replied that there was fair hearing on the other side.

Dr. PRITCHARD said he would leave it alone.

Mr. HEATH also agreed that the chances of improvement by operation were very remote.

Mr. W. C. BULL showed the *Left Temporal Bone of a Man, aged twenty-one, who had died from Cerebellar Abscess.*

Purulent otorrhœa had existed for twenty years; facial paresis fourteen days. No optic neuritis. No vomiting. Intense pain. Speech normal; gait normal. The existence of the abscess was not suspected. The complete mastoid operation was performed, and the bone in the region of the antrum and tympanum found to be black. Two openings were found, one leading from behind the ridge of the canal of the facial nerve and passing toward the canal, the other passing directly from the tympanic cavity through the wall into the labyrinth. The man died on the third day after the operation, from bursting of a large cerebellar abscess.

Post-mortem.—The discolouration of the temporal bone extended to the apex of the petrous portion. There was some caries on the superior surface of the bone in the middle fossa. The meninges were not inflamed. The lateral sinus was normal. Infection had passed from the tympanum through the labyrinth, or along the canal of facial nerve to the internal auditory meatus, and thence to the cerebellum.

Mr. CHARLES HEATH thought the case showed that facial paralysis was an indication for early operation, as it implied progressive disease. In December last he operated in one day upon two cases of mastoid disease with facial paralysis. The complete radical operation was performed in each case. In one the paralysis disappeared

in three days; in the other, after removing the bridge over the aditus, a depression was seen on the inner wall of the groove about the size of half a small pea. This was the site of exposure of the facial nerve, which could be touched with a probe and the facial muscles moved. The paralysis in this case was recovered from slowly, the eye taking six weeks. There was a large opening between the antrum and lateral sinus in this case, and between the antrum and middle fossa in the other, yet there were no intra-cranial or vascular symptoms whatever. Last year he operated on a man with chronic aural suppuration with pain, fever, and optic neuritis. He was giddy and looked ill. He opened the mastoid antrum and found only the usual suppuration. He then exposed the dura mater of the middle fossa; it looked natural, was not discoloured nor unusually tense. A friend who knew the symptoms before operation suggested exploration of the middle lobe. Mr. Heath decided to do that later had it been necessary. The patient improved in everything but his optic neuritis, so at the end of two weeks iodide of potassium was given, and the neuritis disappeared in three or four days, and his recovery was complete.

Dr. Milligan asked what was the exact cause of death in Mr. Bull's case.

Mr. Bull, in reply, said he was not sure that his description of the specimen was right; the disease appeared to have gone straight through the labyrinth, and not along the canal for the facial nerve. He had not the faintest suspicion of there being an abscess. The specimen was interesting because of the great discolouration of the petrous bone, the opening from the middle ear into the aqueductus Fallopii, and the direct opening into the labyrinth. There was no opening either through the roof of the tympanic cavity or posteriorly, so that the abscess did not go through into the temporo-sphenoidal lobe, and did not travel backwards into the cerebellum, but tracked along the canal of the facial nerve, or through the labyrinth to the internal auditory meatus, and thence into the cerebellum. As far as he could judge, the abscess had been there three or four months, during which time the man was walking about. He had no staggering, or nystagmus, or optic neuritis, or vomiting. At twelve o'clock one night he became violently maniacal, and died at five o'clock in the morning. There was no suspicion that he had abscess. The bones in these cases were generally spoilt by the *post-mortem*. He exhibited the bone showing what the condition was. The specimen is in the museum of St. George's Hospital.

THE ÆTIOLOGY AND TREATMENT OF LABYRINTHINE SUPPURATION.

By William Milligan, M.D.

Mr. President and Gentlemen,—Septic disease of the labyrinth demands our most careful consideration, in the first place on account of the damage which may be done to the acoustic or to the static segments of the internal ear, and in the second place on account of the risk which exists of the pathogenic process extending to the basal meninges or to the adjacent lobes of the cerebellum. The most frequent causes of infection of the internal ear are as follows:—(1) Suppurative lesions of the middle ear extending through the external labyrinthine wall; (2) suppurative processes originating at the base of the brain and extending along the perivascular or perineural sheaths of the auditory or facial nerves; (3) deposition of pathogenic organisms by the general blood-stream in some portion of the internal ear; (4) injuries.

The most frequent and, from the practical point of view, the most important cause is extension from the cavity of the middle ear. In the great majority of cases due to this particular cause perforation into the labyrinth has taken place, either as the result of erosion of the bony labyrinthine wall or as the result of maceration of the fibrous structures uniting the foot-plate of the stapes to the margins of the foramen ovale or of the membrana secundaria covering the fenestra rotunda.

Perforations leading into the cavity of the internal ear may also be of traumatic origin, as in cases of fracture of the base of the skull, direct injuries, *e. g.* foreign bodies introduced into the meatus, or as the result of operative interference, the labyrinth being opened either intentionally or accidentally. The virulence of the infection and its exact exciting cause determine to some extent at least the nature, extent, and behaviour of the resulting inflammatory process. In cases which run a slow and almost painless course a cario-necrotic process is induced, which may result in the whole or considerable portions of the labyrinth being exfoliated in the form of sequestra. In such cases the disintegrating process is frequently of a tuberculous nature. In other cases, however, the infective process may be so acute as to lead to the rapid transference of infective organisms along the perivascular or perineural sheaths of the auditory or facial nerves to the base of the brain.

The frequency of labyrinthine suppuration is difficult to gauge, partly because in most clinics sufficiently detailed statistics are but rarely kept, and partly because the attention of the profession has not as yet become sufficiently focussed upon this particular complication of middle-ear disease as a factor in the production of high degrees of deafness and of intra-cranial involvement.

The route of most frequent infection from the middle to the internal ear is through a fistulous tract in the horizontal semicircular canal, and the second most important pathway is through the fenestra ovalis. In a recent paper by Victor Hinsberg, out of 198 cases of labyrinthine suppuration collected by him from various sources the pathway of infection was definitely established in 61 cases. In 27 a fistula was found in the horizontal semicircular canal (Fig. 1); in 17 the infective organisms had entered the internal ear by way of the fenestra ovalis (Fig. 2), in 2 by way of the fenestra rotunda, in 3 through both windows; in 7 a fistula was found in the pars promontoria, and in 8 through the posterior or superior semicircular canal.

Labyrinthine suppuration is rare as the result of acute middle-ear sepsis, and for precisely the same reasons as intra-cranial complications are comparatively uncommon after acute suppurative otitis media. Considerable time is required before the invading army of micro-organisms is able to penetrate the dense bony capsule of the labyrinth or the compact strands of fibrous tissue which close in the fenestræ. The precise point of invasion and the virulence of the pathogenic process determine the particular segment of the internal ear which is involved and the extent of the involvement. In 18 cases out of a total of 89 collected by Hinsberg the labyrinthine involvement was due to acute otitis media, in 71 to chronic disease. In 21 of the 71 cases following chronic suppurative otitis media cholesteatomata were present. In some cases the septic process becomes localised to the region of the semicircular canals, to the vestibule, or to the cochlea. Usually, however, the contiguity of these various segments determines their almost simultaneous infection. Circumscribed necrosis most usually affects the external lamella of the pars promontoria, which is thrown off in the form of a thin plate of bone. Occasionally the whole or a considerable portion of the cochlea may come away as a sequestrum. In other cases portions of the semicircular canals become detached and exfoliated. The accompanying photographs (Figs. 3, 4, 5) show portions of the cochlea and of the semicircular canals removed by operation from a male patient who had suffered from chronic suppurative middle-ear disease for over twenty years, and whose main

FIG. 1.—TEMPORAL BONE SHOWING FISTULA IN EXTERNAL SEMICIRCULAR CANAL.

FIG. 2.—TEMPORAL BONE SHOWING FISTULOUS TRACT LEADING INTO VESTIBULE.
To illustrate Dr. MILLIGAN's paper on the Ætiology and Treatment of Labyrinthine Suppuration.

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symptoms before admission to hospital had been deep-seated pain in the head, severe attacks of vertigo, and profound deafness upon the affected side. A radical mastoid operation was performed and extended into the labyrinth, where the sequestra were found embedded in soft granulation tissue. After removal marked improvement in the general and local condition of the patient at once set in.

In tuberculous disease of the middle ear this particular portion of the external labyrinthine wall is frequently invaded. Of 33 cases of labyrinthine tuberculosis collected by Barnick both fenestræ were found perforated in 5 cases, the oval window alone in 2, the round window alone in 3.

When the inflammatory process remains circumscribed the round-celled infiltration which takes place becomes ultimately organised, with the result that the spaces existing in the internal ear become filled up by a dense fibrous tissue, which ultimately becomes ossified. Once the labyrinth has become the site of purulent invasion, the risks of extension to the base of the brain are obvious. The normal pathways which exist between the internal ear and the basal meninges are the tracts along which pathogenic organisms travel. In the great majority of cases infection from the labyrinth attacks structures within the posterior fossa. A few cases, however, are on record where the pathological process has caused carious erosion of the anterior crus of the superior semicircular canal with the result that the middle cranial fossa became opened and infected. Most usually the resulting intra-cranial infection takes the form of a diffuse suppurative pia-arachnitis. Occasionally it remains as a localised process, *e.g.* an extra-dural abscess in the posterior fossa or over the tegmen tympani in the middle fossa. The contiguous portions of the lateral lobe of the cerebellum are also prone to become infected. Undoubtedly a large proportion (probably 20 to 30 per cent.) of the cerebellar abscesses met with in practice are due to labyrinthine infection.

Septic invasion of the labyrinth may run an acute or a chronic course. When acute, certain striking symptoms present themselves. Thus deep-seated boring pain is complained of, there is a rapid elevation of temperature and other febrile indications, sickness or nausea is almost invariable, and vertigo is so pronounced as to necessitate the patient's remaining in the horizontal position. Nystagmus either in the vertical or in the horizontal plane is common, whilst rapid and at times complete nerve-deafness is almost invariable.

In the more usual class of case, however, the invasion of the

labyrinth runs an almost chronic course, the external labyrinthine wall slowly crumbling away as the result of micro-organismal attacks. In such cases symptoms, although fairly characteristic, are not nearly so well marked as in acute infections. Pain is frequently absent, vertigo is not so pronounced, often being more of the nature of a swimming sensation in the head, there is slight, if any, elevation of temperature, and sickness is by no means constant. The existence of these symptoms combined with a rapid onset of nerve-deafness and the frequent presence of nystagmus should at once attract attention to the probability of the internal ear being affected. Another important symptom is the presence of facial paresis or paralysis. Facial paralysis supervening in the course of a chronic suppuration of the middle ear is always a signal of deep-seated disease. Too often, I think, it is regarded as an indication of middle-ear disease. I am satisfied from clinical and from *post-mortem* experience that its onset frequently indicates a labyrinthine lesion, the nerve being implicated in its passage through the pars petrosa and before it has reached the cavum tympani. In exceptional cases where the process is localised the symptoms will depend upon the particular portion of the internal ear which is involved, viz. the static or the acoustic segments. Where the cochlea is involved symptoms referable to disease of the terminal filaments of the auditory nerve will be present. Thus tinnitus is always complained of, whilst a varying amount of loss of perception for high tones will be met with, according to the extent and situation of the existing lesion. In the great majority of cochlear lesions high degrees of deafness are found.

Should the suppurative process, however, be confined to the region of the semicircular canals or vestibule, the predominant symptoms will be vertigo, nystagmus, and intermittent attacks of nausea or actual sickness. In 57 out of 97 cases of uncomplicated fistula of the horizontal semicircular canal Jansen found marked vertigo to be present, whilst Lucae, in 30 out of his 50 cases, found the same conditions prevailing.

In localised suppuration of the semicircular canals or vestibule a fair degree of hearing may exist. The occurrence of rapidly advancing nerve-deafness in a case of chronic suppurative disease of the middle ear should at once direct attention to the probability of labyrinthine involvement. If accompanied by vertigo, attacks of sickness, nystagmus, and constant tinnitus, the diagnosis is of course rendered somewhat easier, although the possibility of a concomitant lesion of the cerebellum must not be lost sight of. In actual practice we have to deal with cases where the lesion

secondary to the middle-ear infection is confined to the labyrinth—probably a much more frequent condition of affairs than is usually supposed,—where it is confined to the cerebellum, and where both a labyrinthine and a cerebellar lesion co-exist. An accurate differential diagnosis is at times a problem of the utmost difficulty, the symptoms being in many cases so similar.

In uncomplicated labyrinthine suppuration without any intra-cranial lesion greater degrees of nerve-deafness are usually present, vertigo is more of the nature of the subjective sensation of extreme dizziness than of that form of staggering gait known as the cerebellar gait, sickness and prostration are less marked, occipital pain and retraction of the head are absent, optic neuritis, which is present in about 70 per cent. of the cases of cerebellar abscess, is also absent, whilst the dull and somnolent condition of the patient are more suggestive of a cerebellar than of a labyrinthine lesion. In addition the peculiar coiled-up position of the patient when lying in bed, and the occasional existence of motor paresis or paralysis of the same side of the body, are highly suggestive of a cerebellar abscess. Mechanical yawning is also almost pathognomonic of intra-cranial abscess. Nystagmus is comparatively common in labyrinthine suppuration.

Jansen and Lucae found it present in all their cases of traumatic perforations. Jansen also found it present in 24 out of 97 cases of carious perforation—practically 25 per cent.,—whilst Lucae found it present in 31 per cent. of his cases of fistula of the external semicircular canal.

The co-existence of cerebellar abscess with labyrinthine suppuration, although by no means uncommon, is extremely difficult of diagnosis, and is frequently only found out in the course of operative procedures, or as the result of the after-history of the case.

The following notes present a typical picture of an uncomplicated case of labyrinthine suppuration:

D. S—, male, aged twenty-nine, had suffered for eleven years from profuse discharge from his left middle ear following a severe attack of scarlet fever. The discharge was fœtid and blood-stained. His hearing power had for long been much impaired, and had become rapidly worse a few weeks prior to being seen in consultation. Severe vertigo was complained of, and on two occasions he had vomited quite suddenly and quite independently of the partaking of food. No definite pain either in the ear or in the head was complained of, but he felt ill, and was quite unable to follow his usual occupation. When first seen the following notes

were made :—Patient pale and anæmic, tongue thickly furred, bowels constipated, temperature 97·8° F., pulse 70. Left auditory meatus blocked by a large œdematous polypus in a bath of putrid pus. Bare bone felt by means of a probe in the depths of the meatus. Hearing upon the affected side one-sixtieth of the normal. Tuning-fork tests show want of perception for high tones; no nystagmus; no optic neuritis. Under chloroform anæsthesia a complete radical mastoid operation was performed and a careful toilet of the external labyrinthine wall was made. The stapes was found embedded in granulation tissue, and when gently grasped with a pair of forceps at once came away. Succulent granulation tissue was seen to fill the vestibular cavity. By means of a small bur the fenestra ovalis was carefully enlarged, and a quantity of disorganised tissue was removed from the vestibule. Either during the enlargement of the fenestra ovalis, or during the subsequent process of curetting, the facial nerve was injured, and for a short time after operation facial paresis existed. This, however, ultimately entirely cleared up. The cavity thus made in the labyrinth was lightly packed, and the subsequent treatment of the radical mastoid operation carried out upon recognised principles. The patient made a good although slow recovery, and is now at work as usual. All vertiginous symptoms disappeared after the operation. He is, however, completely deaf upon the affected side.

To illustrate the practical difficulties encountered in making an accurate diagnosis where labyrinthine and cerebellar suppuration co-exist, the following case, which was diagnosed as one of labyrinthine suppuration, may be cited. Unfortunately the possibility of a co-existing cerebellar abscess was not entertained at the moment. Four days after the labyrinthine operation, however, a cerebellar abscess was opened, but with an unsucessful result.

J.T—, male, aged thirty-three, was admitted to hospital complaining of deep-seated pain in his left ear, marked vertigo, and constant nausea. Examination showed chronic left-sided purulent otitis media, deep-seated caries, bone granulations, and severe nerve-deafness upon the affected side. His temperature on admission was 102° F., his pulse 64, and his respiration 20. For three or four days prior to admission he had complained of severe dizziness, and on two or three occasions had been sick. A diagnosis of labyrinthine suppuration was made. Under an anæsthetic a complete radical operation was performed, the facial spur being freely removed, so as to gain a good view of the external labyrinthine wall. A fistula was at once seen in the region of the horizontal semicircular canal leading into the internal ear. A small sequestrum

was scooped out, and some succulent granulation tissue was removed with the curette. The after-treatment was conducted upon ordinary principles. The patient did not, however, rally from the operation as had been anticipated. The temperature became subnormal (96·4° F.), and he sank into a dull, listless, and apathetic mental condition. Occipital pain increased slightly, and one or two attacks of vomiting during the two days subsequent to operation made it evident that some other complication existed. It was accordingly decided to explore the adjacent portion of the cerebellum. Four days after the first, or labyrinthine operation, the cerebellum was opened, and an abscess occupying the anterior portion of the left lateral lobe at once found. After evacuation of pus and a few shreds of disorganised brain tissue a drainage-tube was inserted. The patient, however, did not rally, and died the following day. Unfortunately a *post-mortem* examination could not be obtained.

In this case, had a correct diagnosis of labyrinthine *plus* cerebellar suppuration been made, and had both purulent foci been evacuated at the same time, the result might have been very different. On the other hand, the symptoms of labyrinthine suppuration may so resemble symptoms of cerebellar abscess as to lead to the diagnosis of a mixed lesion when the labyrinth is the part alone involved. The fact also that in suppurative labyrinthitis the amount of cerebro-spinal fluid is increased with a corresponding increase of intra-cranial tension, as evidenced by depression of the various vital centres, slow pulse, subnormal temperature, and slow respiratory movements, tends to materially increase the difficulties of differential diagnosis.

The following case illustrates this point:

J. L—, aged thirty-one, had suffered for many years from left-sided suppurative middle-ear disease. For some days prior to being seen in consultation he had complained of marked vertigo, pain in his head, and general lassitude. Upon examination a small perforation was found in the upper and posterior part of Shrapnell's membrane. The discharge, which was scanty, was very offensive His hearing power measured $\frac{4}{60}$ of the normal and tuning-fork tests pointed to labyrinthine involvement. The attic was carefully cleansed by means of an attic syringe, leeches were applied round the ear, and a large dose of calomel was ordered. The effect upon the patient's symptoms was practically *nil*. When seen again ten days afterwards he was lying in bed, complaining very much of pain in his head and neck, of great photophobia, of sickness, and of swimming sensations whenever he moved in bed. His pulse was 56, his temperature was 97·4° F., and his respirations

were 16. Marked horizontal nystagmus was present. There was no optic neuritis. His mental condition was such as to arouse the suspicion of a cerebellar abscess being present, and operation was advised. The preliminary steps were as in the previous case, and a free opening was made into the labyrinth through the region of the horizontal semicircular canal by the enlargement of a small fistula which was found. A disc of bone was then removed over the left cerebellar lobe, and the dura incised. A very free flow of cerebro-spinal fluid took place, the amount being obviously much in excess of the normal and under considerable tension. The cerebellar lobe was explored in four different directions, but no pus was found. The patient made an uninterrupted recovery, and is now in the enjoyment of excellent health. His hearing upon the affected side, which previous to operation had measured $\frac{4}{60}$, is now quite gone, the labyrinthine operation having destroyed the little he previously possessed. The case was thus one of suppurative labyrinthitis complicated with serous meningitis.

In such cases lumbar puncture might prove an aid to diagnosis. Where a perfectly clear fluid escaping under tension is drawn off a serous meningitis may be assumed to exist. Where, however, the fluid escaping under tension is turbid and microscopically is found to contain micro-organisms and pus-cells, the existence of a purulent meningitis is certain.

Prognosis.—In all cases of labyrinthine suppuration the prognosis is necessarily grave. The ever-present proximity of the pia-arachnoid membranes and the intimate relationship which exists between the sub-arachnoid cavity and the peri- and endolymphatic spaces necessarily render the spread of septic processes from the internal ear to the base of the brain by no means improbable. The relation also of the corresponding cerebellar lobe to the posterior surface of the pars petrosa is another factor always to be remembered. Various other points must also be considered, viz. the acuteness or otherwise of the inflammatory process, its particular cause and nature, its extent and situation, and the age of the patient.

So far as the function of audition is concerned, it will be found that in the great majority of cases irreparable damage is done, whilst in some cases complete destruction of the internal ear and auditory nerve takes place. In acute cases suppuration may come to an end spontaneously. Healing may then result, the affected portions of the internal ear filling up with granulation tissue, which subsequently undergoes ossification.

In chronic cases the risk of extension to the base of the brain

or to the adjacent cerebellar lobe must always be borne in mind, and this risk is the greater the younger the patient. According to Bezold, 20 per cent. of the cases of labyrinthine necrosis die from consecutive brain and sinus affections.

Labyrinthine suppuration following the exanthemata, especially scarlet fever and cases which are of tuberculous origin, are more dangerous than are those due to more ordinary causes. Where disease is localised and confined to the region of the semicircular canals the prognosis is better than where the whole contents of the labyrinth are involved. Under such circumstances from 20 to 30 per cent. of the cases prove fatal.

Complications.—Intra-cranial complications are frequent. From a study of recorded statistics and from observations of my own I have arrived at the conclusion that from 40 to 50 per cent. of the cases are followed by complications, usually intracranial in nature. By far the most frequent pathway of infection is *viâ* the internal auditory meatus along the sheaths of the auditory or facial nerves, and the second most frequent route is *viâ* the aqueductus vestibuli.

Suppurative pia-arachnitis is the lesion most frequently met with, usually diffuse, occasionally localised. Extra-dural abscesses around the sigmoid sinus or over the superior semicircular canal in the middle fossa are also encountered, as are also cerebellar abscesses, developing as a rule in that portion of the lateral lobe nearest to the original focus of infection. As a factor in the production of cerebellar abscess, suppurative disease of the labyrinth is of the first importance. Phlebitis of the sinus and of the jugular vein at times owe their origin to disease in this region. Jansen has described cases of jugular phlebitis following labyrinthine suppuration, the septic process travelling along the cochlear or vestibular veins.

Of the 198 cases collected by Hinsberg, the cranial cavity was affected in 108. In 43 of these cases the pathway of infection was definitely traced, and was as follows:

In 25 cases through the internal auditory meatus; in 1 case through the internal auditory meatus and aqueductus; in 8 cases through the aqueductus vestibuli; in 1 case through the aqueductus cochleæ, and in 8 cases through fistulæ in the vertical canals.

The operative exposure of the cavity of the middle ear may be the cause of the extension of latent suppuration of the labyrinth to the cranial cavity.

In 169 cases of radical mastoid operation performed by Brieger

for prophylactic reasons there were five deaths from meningitis, and in all five the meningitis was due to a concealed labyrinthine suppuration.

In one of my recent cases meningitis developed after the radical operation, and was due to an unrecognised and concomitant suppuration of the labyrinth which evidently became lit up as the outcome of surgical interference.

Suppuration occurring in the posterior segments of the labyrinth may set up a secondary empyema of the saccus endolymphaticus. An empyema in this situation may suddenly rupture into the meninges and produce a rapidly spreading pia-arachnitis.

Treatment.—In order to secure access to the external labyrinthine wall a free exposure of the middle-ear cavity must be effected (Fig. 6). This is best secured by the performance of the typical radical mastoid operation. Sufficient bone must be removed to secure a good view of the region of the oval window. Careful search should be made under good illumination for any fistulous tract leading through the bony wall, or through one or other fenestra. When found the tract should be carefully enlarged by means of the bur, and the path of infection followed until all granulation tissue and purulent *débris* has been got rid of. This may require a prolonged and deep exploration. As the fistulous tract is in the majority of cases found in the horizontal semicircular canal, the operation does not present unusual difficulties. By extending the dissection along the anterior crus of the horizontal semicircular canal the vestibule may be opened, or by extraction of the stapes and enlargement of the fenestra ovalis in a downward direction the same result may be obtained.

The cochlea may be opened up by removing the pars promontoria in a direction forwards and inwards. The first whorl is in this way rendered accessible. Great care must, however, be exercised when working in this region, on account of the near proximity of the internal carotid artery (Fig. 7), which occasionally runs an aberrant course and projects inwards towards the tympanic cavity. Provided, however, the field of operation is kept well illuminated and dry, there should be no fear of wounding the artery.

In discussing the indications for operation we are faced by the fact that clinical experience has taught that in cases running a severe and acute course resolution may take place, whereas cases which appear slight and comparatively symptomless may suddenly light up and end in acute intra-cranial infection.

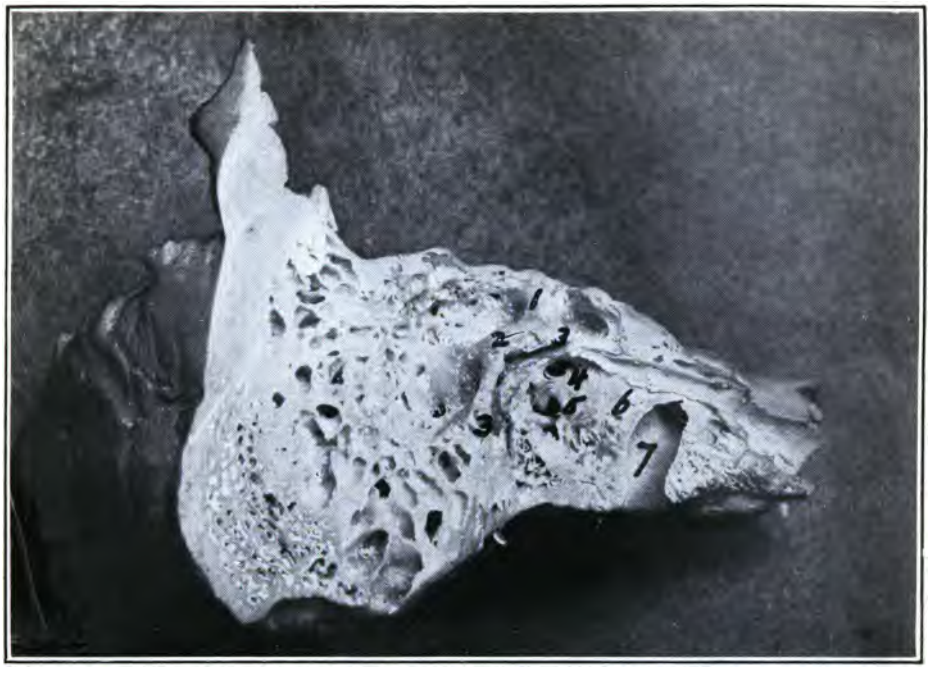

FIG. 6.—SECTION OF TEMPORAL BONE SHOWING LANDMARKS OF IMPORTANCE.

1. Superior semicircular canal. 2. External semicircular canal. 3, 3. Facial canal. 4. Fenestra ovalis. 5. Fenestra rotunda. 6. Pars promontorium. 7. Carotid canal.

FIG. 7.—TEMPORAL BONE SHOWING RELATION OF THE FIRST WHORL OF THE COCHLEA TO THE CAROTID ARTERY AND TO THE FENESTRA OVALIS.

To illustrate Dr. MILLIGAN's paper on the Ætiology and Treatment of Labyrinthine Suppuration.

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I would venture to lay down the following points as guides to operation:

1. In any case of suppurative middle-ear disease where well-marked nerve-deafness upon the affected side is accompanied by frequent attacks of vertigo and sickness, and by nystagmus, either constant or intermittent, a careful search should be made for the presence of any fistulous tract leading into the labyrinth. If found such tract should be opened up and explored; if not found, however, an exploratory opening through the horizontal semicircular canal or foot-plate of stapes is justifiable.

2. In all cases of suspected labyrinthine disease of septic origin the vestibule should be promptly opened.

3. In cases of chronic suppurative middle-ear disease accompanied by the presence of cholesteatoma and erosion of the external labyrinthine wall free opening of the area of involvement should be effected.

4. In cases of suspected cerebellar abscess accompanied by symptoms indicative of labyrinthine involvement the operative pathway should be *viâ* the middle and internal ear to the posterior surface of the pars petrosa—in other words, through the median wall of the mastoid antrum. In this way the labyrinth is opened up, the anterior portion of the corresponding cerebellar lobe is exposed, and any extra-dural abscess lying upon the posterior surface of the pars petrosa would at the same time be located and drained.

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SIXTEENTH ORDINARY MEETING.

Monday, March 7th, 1904.

THE PRESIDENT, DR. THOMAS BARR, IN THE CHAIR.

The following gentlemen were elected ordinary members of the Society :—

JOSEPH NELSON, M.D., R.U.I., L.R.C.S.Ireland (Belfast).
JAMES HENDERSON NICOLL, M.B., C.M.Glas. (Glasgow).

The PRESIDENT said that the Glasgow members had sent a very cordial invitation to the Society to hold its Annual Extra-Metropolitan Meeting in Glasgow. The Society must justify its title to the name of Otological Society of the United Kingdom, and not limit its meetings to London, but occasionally meet in some of the provinces. They had already met in Edinburgh, in Dublin, and in Liverpool, and the Council had now agreed to accept the invitation from Glasgow, and had decided to hold the meeting on Saturday, May 21. Every effort would be taken to make the meeting a success, and they hoped that as many as possible would endeavour to be present.

The PRESIDENT then invited the members to resume the discussion on Dr. William Milligan's paper on "The Ætiology and Treatment of Labyrinthine Suppuration," which was read at the previous meeting.

Mr. ARTHUR CHEATLE said he was very much interested in Dr. Milligan's paper. The symptoms of labyrinthine involvement had been recognised for a great many years, and had been pointed out to him twelve years ago. He had seen patients with the classical symptoms recover without any operative interference. He wished to know of anything which would indicate where operations on the labyrinth were to be limited. For instance, supposing a carious spot was found on the horizontal semicircular canal or promontory, it might mean that actual perforation had or had not occurred. Were we to limit the operation to the actual spot affected, hoping the disease had been shut off from the labyrinth as a whole, or were

we to take it that the whole labyrinth was affected and required more radical measures? In two of Dr. Milligan's cases, recovery occurred after mere local interference; but in another, although the local trouble in the canal only was dealt with, yet the patient died with symptoms which pointed to the whole labyrinth having been affected. In discussing treatment, Dr. Milligan stated that the vestibule might be opened by following the anterior cells of the horizontal semicircular canal, but Mr. Cheatle thought it would be better to follow the posterior, as it led to the lowest part of the vestibule, was away from the facial nerve, and was on the way to the cerebellum. With regard to the symptoms which required the opening of the labyrinth, Dr. Milligan said that, if the classical symptoms existed without any fistula being found, the labyrinth should be opened. Mr. Cheatle thought they ought to be cautious in accepting this, for the symptoms sometimes cleared up without operative interference at all, or after the performance of the complete post-aural operation. He thought that the operation of dealing with the labyrinth might well be done in stages.

Mr. A. L. Whitehead thought in one respect Dr. Milligan's paper was rather disappointing, and that was in the absence of details with regard to his own personal experience. Only isolated cases had been mentioned, and he (the speaker) did not know of the existence of any record or statistics of cases from an English clinic. He therefore thought it might prove interesting to those present if he gave a summary of 691 cases that had been operated on by his colleagues and himself during the last thirteen years.

Mr. Whitehead's communication will be found on page 49.

Dr. Pritchard said he had not many remarks to make on Dr. Milligan's excellent paper, but he wanted to warn the readers of the paper not to pay too much attention to vertigo as necessarily indicating disease of the labyrinth. He did not say exactly that Dr. Milligan had laid that down, but he felt that many reading the paper would be liable to pay too much attention to that, and not enough attention to the question of almost complete deafness. Practically, these cases seemed to divide themselves into two, those in which there was necrosis and those in which there was a carious sinus. It was quite evident what to do in the cases with necrosis—remove it. In cases where the sequestrum was not loose an old plan, he had adopted with a good deal of success, was to use an injection of 1 per cent. of nitric acid, and in a few days the sequestrum became decalcified, and then it might be removed without injuring the adjoining tissues.

Dr. DUNDAS GRANT thought the Society ought to congratulate itself on this subject being brought before it. Dr. Milligan had placed the whole matter before them in that peculiarly happy and acceptable way in which he dealt with so many of the questions of otology. Having read what the German writers had to say on the subject, he thought they would possibly feel that we in this country were a bit behindhand in following up this subject. Whatever the reason might be, he thought what they had heard that day had helped to explain it—it was their extreme modesty, because Mr. Whitehead had brought before them a heap of material of which he felt sure nobody had any idea of its existence, and he thought that that contribution by Mr. Whitehead was one on which the Society was to be particularly congratulated. There still remained, however, a large number of cases in which the disease of the labyrinth could not be diagnosed. Dr. Brieger, who was a very candid observer, had recorded that out of 169 cases eight had died, and out of those five from meningitis in which the suppuration of the labyrinth was absolutely latent. In three meningitis developed immediately after the operation. With regard to the question of diagnosis when fistulæ, or what they took to be fistulæ, were discovered, Mr. Cheatle had hit upon a point which had struck others, and in a paper which he (the speaker) had lately been reading the author pointed out that this diagnosis was somewhat affected by what he called the subjectivity of the observer, and that some were more ready to detect fistulæ than others. As Mr. Cheatle had said, there could probably be no greater mistake than to probe deeply into a partly eroded semicircular canal to find whether there were or were not a fistula. Then came the question of the numerous cases which they had all met in the course of their practice which had eluded their observation. In future, perhaps, they might be unhappy enough to detect fistulæ much more often than they had in the past; but in the happiness which was sometimes associated with defective knowledge of the subject there could be no doubt that they had in the course of careful operations brought about a condition of things which was desirable in order to lead to a cure of disease of the labyrinth. The operation had unfortunately a tendency to excite labyrinthine suppuration, and in those circumstances he thought it behoved them all to be very careful in their mastoid treatment. He thought that was one of the lessons to be drawn from the study of the subject.

Mr. C. H. FAGGE said that within the last four years he had operated on six cases of middle ear suppuration in which the

labyrinth also was apparently involved. In three of these the lesion was gross and unmistakable, but in the other three it was apparently slight, and mainly on account of diminished bone conduction he had advised a radical mastoid operation. At these operations he found no evidence of fistulæ in the external semicircular canal or elsewhere into the labyrinth, which, therefore, was not explored, and healing followed in each case. Afterwards, in one of these cases, he was surprised that the diminished bone conduction was no longer present. He had several times in the course of a radical mastoid on the cadaver tried to explore the labyrinth through the oval window below the facial canal with a small dental burr, and he had found it impossible by this route to investigate the vestibule. He wished to ask Dr. Milligan what instrument he used and how this was done.

Mr. R. Lake thought they were very much indebted to Dr. Milligan for bringing the subject before them. Interesting cases of suppuration of the labyrinth had been reported from time to time in which very careful examination had been made. He referred to a case which he thought might be used in helping to settle symptoms, and that was reported as far back as 1836, in which a man had a needle broken in his ear and it went through the membrane, and the man died of acute labyrinthine suppuration in four days. With regard to the symptoms, in acute conditions of labyrinthine disease sometimes there was deafness and sometimes not. There was a book published in 1899 in which the author described all the symptoms, and said one might get any one of the classical symptoms in which labyrinthine suppuration might be absent. Another important point was the question of falling. Sometimes patients had a tendency to fall towards the affected side and sometimes away from it. He believed if only the external canal was involved the patient fell towards that side; but if all the canals, the patient would fall towards the other side. Another interesting question was that of the occlusion of the semicircular canals, which was frequently found in acquired deaf mutism, which he would suggest had been due to an infection of the semicircular canals from meningitis, or other disease of the meninges.

The President said that he quite agreed with Dr. Milligan when he said that the attention given by the profession to this subject had not hitherto been sufficient, and they were all indebted to Dr. Milligan for thus focussing their attention upon the labyrinthine cavity as a seat of suppuration. A very interesting point was the relation of this form of suppuration to the cerebellar fossa. There was no doubt that when extension to the intra-cranial cavity takes

place it is in that direction, very frequently leading to meningitis of the posterior fossa—hence the gravity of labyrinthine suppuration. When, in a case of purulent ear-disease, there are present the phenomena which indicate an intra-cranial lesion, much information as to the probable seat of the lesion might be obtained from the examination of the labyrinthine wall during the performance of the radical mastoid operation. Hence the importance of scrutinising carefully the inner wall of the tympanum during the operation, especially of those areas to which Dr. Milligan had referred; because if erosions were found there yielding pus, the discovery would form a clue to the seat of the intra-cranial mischief, namely, the cerebellar fossa. That was a point of great importance, and one to which in the future, after reading Dr. Milligan's paper and hearing this discussion, he would be disposed to pay still further attention. Another point to which he would draw attention is the relation, in such cases, of bone-conduction of sound to air-conduction. Not long ago a case came under his notice, which impressed him, of death from septic lepto-meningitis of the cerebellar fossa, in which the intra-labyrinthine structures were entirely destroyed by suppuration. The state of the bone- and air-conduction was examined during life while the patient could give reliable answers to questions, and he (the speaker) found, notwithstanding the condition of the labyrinth, as shown by *post-mortem* examination, that excess of bone conduction was present on the affected side, and as that was contrary to what the patient would naturally expect he thought they could rely upon the accuracy of the test. Dr. Jacobson, of Berlin, had also noticed a similar case. Such observations might lead them to modify their views as to the diagnostic value of predominance of bone-conduction over air-conduction. In conclusion, he thought that the members of the Society were very much indebted to Dr. Milligan for the trouble he had taken in the preparation of this important paper.

Dr. Milligan, in responding, thanked the members of the Society for the very kindly reception which had been accorded to his paper. His object in bringing the communication before the Society was not because he had had any very great experience in the subject, but because he thought it was one that had not received the attention which it ought to receive, and he felt that discussion upon it might bring up various practical points which would be of use to all. He thought the points raised were of great practical value, and would lead them to think about the subject, and at any rate would make them realise that there was such a thing as labyrinthine suppuration, and enable them to avoid mistakes owing to

the difficulties of its detection by ordinary symptoms, and so help them at times to save the lives of patients. With regard to Mr. Cheatle's question as to how far they were to go in their investigations, that particular point must be left to each individual operator. If a fistula were found in the bone one must follow its track; if it went deep into the labyrinth he saw no reason why it should not be followed to its utmost limits. With regard to the question whether the discharge stopped or not in the cases reported, the discharge was completely stopped in two cases, and the patients were now at work again, but the third died. With regard to the opening of the vestibule, he had opened it along the anterior crus, and for the purpose he had used a very minute burr driven by an electric motor. The enlargement of the oval window was only possible by a very free cutting away of bone, but he had no doubt that in certain cases it would be impossible. As to the question of injury to the carotid artery, he saw no reason why it should be injured any more than in dissecting out glands in the neck. He thought Mr. Cheatle's suggestion as to operating in stages was a good one because it was a lengthy operation. On the other hand, there was always an advantage in finishing an operation of this nature as quickly as possible; the patient was in considerable danger, and it was better to finish at one operation if possible. Although he was quite unable to criticise Mr. Whitehead's contribution, yet he felt extremely indebted to him for bringing forward such a valuable mass of statistics. No doubt there was considerable risk in removing a sequestrum, and one had to be very careful. If the sequestrum was fairly fixed, his opinion was that it was best to leave it for the time being, or else follow out Dr. Pritchard's suggestion of using some decalcifying preparation. Then with regard to the question of complete deafness or not, raised by Dr. Pritchard, none of the cases he had seen were absolutely deaf—there was a little hearing. He fancied it depended upon the particular part involved. There were times when no definite fistula existed, and that was a point they ought to be extremely careful about. Personally he believed in having a very strong light when operating, and he had always used a limelight, and found it very good. Reference had been made to the question of diminished bone conduction, but that was not necessarily a sign of internal ear disease. When performing any operation for chronic suppuration they ought to examine most minutely to see whether there was or was not a fistula. In many cases fistulæ were very small, and it was only by very great care that it was possible to ascertain their existence.

Dr. DUNDAS GRANT communicated a *Case of Thrombo-phlebitis of the Sigmoid Sinus. Operation without Ligature of Jugular Vein. Recovery.*

The patient, a male aged twenty-four, when first seen on November 5, 1903, was complaining of headache, giddiness, vomiting, and rigors of a fortnight's duration, with a history of suppuration of the left middle ear dating from childhood. There was cough and expectoration, and signs suggestive of tuberculous deposit at the apex of the right lung. The radical operation was performed at once, but temperature continued to oscillate within a wide range. At the end of a week the lateral sinus was exposed for about two and a half inches, and broken-down suppurating clot was found in the position of the "knee" of the sinus. This was cleared away until solid normal-looking clot was reached anteriorly, while posteriorly the lumen of the sinus was perfectly empty. The temperature descended below normal almost immediately, and complete recovery ensued.

Dr. HUGH JONES said he would like to ask Dr. Grant what he meant by the phrase "while posteriorly the lumen of the sinus was perfectly empty."

The PRESIDENT said he wished to refer to one point, and that was the delay from the time of the radical mastoid operation to the exposure of the sinus in the presence of such symptoms as rigors and headache and giddiness. Hitherto he had been in the habit of considering that such symptoms, especially the rigors, demanded immediate exposure of the sinus, and he was rather inclined to deprecate delay in such a case, although in the one referred to by Dr. Grant a happy result followed notwithstanding.

Dr. DUNDAS GRANT, in responding, said that at the knee of the sinus there was a broken-down suppurating clot, and the head of the clot tapered off for the length of about an inch and a half into the lateral sinus, where it lay loose in the channel, which was perfectly empty. This was not collapsed, and, indeed, the possibility of collapse of the sinus was very limited. Apparently there was a blood clot beyond the distance he explored, but it was unjustifiable to push further back. He quite agreed that it would have been better to have explored the sinus sooner than he did, but, as he had said, the patient had signs suggestive of pulmonary tuberculosis, and he thought the continual rise of temperature might be due to disease of the lungs rather than of the sinus. The pulmonary signs cleared up entirely after the treatment of the sinus.

At this point the President had to leave, and Dr. Pritchard took the chair.

Mr. RICHARD LAKE communicated *Four Cases with Sketch Drawings of the Membrana Tympani; One Case exhibited Herpes and Three Cases a Condition nearly allied to, if not actually, Herpes.*

CASE 1.—Occurred in a young man who had complained of aural pain for a few days, and there were some herpetic spots on the concha and lip, but none in the meatus. There were four small vesicles on the membrane, of a slightly yellow hue. The treatment adopted apparently gave him sufficient relief, for he never reappeared.

CASE 2.—The patient was a domestic servant, and had suffered with pain in the ear for about two weeks, which she had attempted to relieve by dropping various things into the ear, one of which was eau de Cologne. On examination a small papule was seen on the handle of the malleus. There were no signs of any other papules elsewhere.

CASE 3.—Occurred in a lady aged twenty-nine, who had had pains in the ear for two weeks, especially noticeable after blowing the nose. She had recently been nursing a child, and had had many domestic worries. She also had, two weeks previously, a slight attack of *Herpes labialis*. On examining the ear the upper posterior portion of the membrane was of a bright red colour, and there was a shallow ulcer visible. This was quite well at the expiration of two weeks. As the inflammation subsided the ulcer took a situation somewhat lower down on the membrane, as was shown by the persistence of a small red spot in the upper and posterior segment for some two or three weeks.

CASE 4.—A child aged seven. Had suffered with pain in the left ear "for weeks." On examination a small, ovoid, pink papule was seen. This was incised, and some iodoform insufflated. Prompt relief was obtained, and the pain did not recur.

Mr. MACLEOD YEARSLEY said these four cases reminded him very much of a case he had met with. The patient, a woman of fifty-four, complained of pain in the ear, and while under his observation she had three attacks of right facial neuralgia. He saw the case at each of the attacks, and they were accompanied by two or three vesicles on the lower part of the right membrane. These vesicles disappeared as the pain subsided.

Dr. FURNISS POTTER communicated a *Case of Appreciable Improvement resulting from Treatment by Pilocarpine Injections in Labyrinthine Deafness.*

The patient, a girl of thirteen, with signs of hereditary syphilis, and family history of same, stated "she had been deaf for some

months, but had become suddenly worse during last two months." There had been discharge from both ears at various times.

On examination (December 31, 1903), hearing for watch was: right ear, $\frac{1}{4}$ inch; left, slightly on contact. Low T.F. not heard on contact, but heard through air; Weber, + R.; Rinné, + both ears. Hearing for voice practically *nil*, conversation being impossible. The patient was given a course of daily subcutaneous injections of pilocarpine.

On January 23, 1904, hearing power for watch: right, 5—6 inches; left, $2\frac{1}{2}$—3 inches.

On January 25, there developed an attack of acute otitis media in both ears, during which deafness increased considerably. Pilocarpine injections were recommenced on February 9, with result that on February 25 patient could hear watch by right ear at 6—$7\frac{1}{4}$ inches, by left at 3 inches. Hearing power for voice was regained, so that conversation could be engaged in when patient was spoken to distinctly and at close quarters. The improvement was maintained.

Mr. Cheatle said there were various things he did not understand in the history of the patient, and he thought they ought to be careful in accepting the conclusions arrived at. Middle ear trouble was mixed up with that of the internal ear. The fact that the watch could be heard and the voice not at all was rather curious. He thought more good would be done in recent cases of internal deafness due to congenital syphilis by repeated blistering than by injections of pilocarpine. The speaker then referred to a case of a child with recent internal ear deafness due to congenital syphilis, which he had seen at King's College Hospital five years ago. For a fortnight daily injections of pilocarpine were used with no result; repeated blistering was then applied, and in a fortnight the patient left the hospital, being quite comfortable. She came up again only the other day saying she was again getting deaf; blistering at once produced marked improvement.

Dr. P. McBride thought Mr. Cheatle was too hard on pilocarpine, and was of the opinion that it was the best remedy they had for internal ear disease, although this was not saying much. Of course one could never be certain that if it had not been for the pilocarpine the patient would not have heard quite well. As to the question of the middle and internal ears, his impression was that most of these were cases where both the middle and internal ears were affected. He thought they ought to be very much obliged to Dr. Potter for bringing this case forward.

Dr. JOBSON HORNE said he was rather inclined to agree with the remarks of Mr. Cheatle. He thought there was more danger of over-stating than of under-stating the benefit derived from the pilocarpine in this case. He would like to hear from Dr. Potter what other remedies had been tried, either before or concurrently with pilocarpine.

Mr. LAKE said he was inclined to support the second speaker.

Dr. DUNDAS GRANT thought pilocarpine was of value in some cases, especially of the congestive form, but if there was any possibility of the patient being anæmic or at all run down it was the one drug of all others that should most carefully be abstained from. From time to time he had employed it, and the rule was for a slight improvement to take place, which disappeared, perhaps, at the end of a fortnight. Within the last few months he had, however, seen a case of a girl who most completely recovered. She developed almost sudden deafness in both ears, and had previously suffered from keratitis. A rash diagnosis of hereditary syphilis was made. Pilocarpine injections were ordered, and after the first she began to hear a little. After the second she could hear the voice, and after the third she could hear absolutely well. It was, of course, a mistaken diagnosis, for it was really a case of hysterical or simulated deafness. Dr. Grant was inclined to believe that many of the reported recoveries under pilocarpine were in more or less merely functional cases.

Dr. PRITCHARD said the only cases in which he had known pilocarpine injections to be of any good were those of congenital syphilis. He remembered just a few cases that had improved under pilocarpine injections, but nothing like the number that had improved under blistering. If they could get hold of the cases moderately early a very fair proportion of them would be greatly improved by repeated blistering. He had found a large proportion of even bad cases of deafness from congenital syphilis very materially improved by early blistering. He believed here and there you might find a case that would be improved by pilocarpine, but personally he should always try blistering first.

Dr. POTTER, in replying, said Mr. Cheatle had thrown some doubt upon the efficacy of pilocarpine, but the improvement in the case given was noted so immediately in connection with the injection of pilocarpine that it seemed to him to be rather running away from the point to say that it was not due to it. With regard to Dr. Horne's question as to whether the patient had had any other treatment, he might say that a couple of months before the pilocarpine she had been treated with one-grain doses of grey

powder (given thrice daily), which had produced no beneficial result. It seemed to him that he had reasonable grounds for assuming a diagnosis of labyrinthine disease, and as to the result of treatment he thought he was justified in supposing that the pilocarpine had something to do with that result. He brought the case forward because it was the only one in which he had found an appreciable result from the use of pilocarpine.

Dr. HUGH E. JONES exhibited a *Temporal Bone with abnormally small Antrum.*

The specimen was from a case of suppurative lepto-meningitis in which the mastoid was opened as a preliminary to further operation. The mastoid portion was wholly diploetic or sclerosed, the antrum extremely small, and its tegmen carious and perforated.

Dr. HERBERT TILLEY said he thought it possible that Dr. Jones had brought forward his specimen because he (the speaker) had raised the question as to the possibility of coming across a mastoid in which there was practically no antrum. He had met with a case in which at the complete mastoid operation he could find only a small blind depression corresponding to the usual position of the aditus ad antrum, and he had thought it worth while to bring it forward. Dr. Jones's was a still more complete case and therefore he (the speaker) was more than ever inclined to maintain that it might be possible to meet with a case in which an antrum did not exist.

Mr. MCBRIDE said these cases brought forward by Dr. Jones and Dr. Tilley interested him very much, because during this year he had operated on a patient in whom there was absolutely no antrum at all, and although it was a very interesting operation he should not like to perform it again. The patient complained of pains in the ear and sickness and vomiting, and the symptoms pointed to some intra-cranial complication. The special features were a very slow pulse and a rather low temperature. He opened the attic and to his amazement found the protector would not pass into the antrum. The patient at first did so well that further operation was delayed but suddenly got worse and died from respiratory failure before intra-cranial exploration could be performed. A large cerebellar abscess, great thickening of the tegmen tympani, and absence of the antrum were found on autopsy. The speaker expected to publish the case *in extenso* later.

Mr. ARTHUR CHEATLE exhibited *Temporal Bones showing some Fallacies of Macewen's Triangle as a Guide to the Antrum.*

Mr. CHEATLE showed eighteen adult temporal bones of various

ages sectioned through the mastoid process and antrum, in which the latter was situated wholly or in greater part above the posterior zygomatic line.

He also showed an adult bone in which Macewen's triangle led straight into the middle fossa.

Dr. JOBSON HORNE showed *Preparations illustrating the Surgical and Morbid Anatomy of Labyrinthine Suppuration.*

The pathological preparations showed the extension of suppuration from the middle ear to the formation of an abscess sac at the site of the saccus endolymphaticus, and the anatomical demonstrated the path of exploration of the labyrinth from the radical mastoid operation.

The pathological preparations will be found fully described in the *Journal of Laryngology, Rhinology, and Otology,* vol. xv, June, 1900.

POSTERIOR PART OF THE RIGHT TEMPORAL BONE FROM CASE I.

The lateral sinus is laid open in its entire extent. A white rod stretches above and across the sinus and lies within the abscess sac. The abscess has perforated in two directions, below, causing septic thrombosis of the sinus from that point downwards, and a bristle passes through a perforation in the posterior wall of the sac, through which pus escaped into the posterior fossa, and caused meningitis and death. Another white rod is placed in the internal auditory meatus.

To illustrate Dr. JOBSON HORNE's Specimens from "Cases of Labyrinthine Suppuration with the Formation of a Circumscribed Interdural Abscess at the Site of the Saccus Endolymphaticus."

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POSTERIOR PART OF THE RIGHT TEMPORAL BONE FROM CASE II.

The dura mater has been reflected inwards; the petrous portion of the bone and the groove of the lateral sinus are laid bare. A glass rod is placed between the position of the aqueductus vestibuli and the internal auditory meatus. Across the rod stretches that part of the dura mater which enters the fissure in the bone at the site of the orifice of the aqueduct and the saccus endolymphaticus. Within this prolongation of dura mater pus has tracked to form the abscess sac, which is shown reflected, together with the dura mater inwards and immediately to the inner side of the glass rod.

To illustrate Dr. JOBSON HORNE'S Specimens from "Cases of Labyrinthine Suppuration with the Formation of a Circumscribed Interdural Abscess at the Site of the Saccus Endolymphaticus."

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SUPPURATION IN THE LABYRINTH.

By A. L. Whitehead, M.B., B.S.Lond.,
Aural Surgeon to the General Infirmary, Leeds.

Hinsberg's paper on labyrinthine suppurations, published in 1902, and translated in an abridged form in the *Archives of Otology*, vol. xxxi, Nos. 2 and 3, has not until quite recently attracted the attention it deserves.

The statistics collected in this paper are from many sources; since their publication only isolated cases seem to have been recorded, and so far as I know there are no statistics from English clinics bearing on this question.

For some years past a careful record has been kept of the cases of temporal bone suppuration which have occurred in the aural department of the General Infirmary at Leeds. During the last thirteen years, our predecessors, my colleagues and myself have operated upon 691 cases of acute and chronic mastoid disease.

Amongst these labyrinthine suppuration was present in 27, or 4 per cent. Of the 27 cases, 11 or over 40 per cent. terminated fatally, and 16 were cured or are at present under treatment with every prospect of cure.

In the 16 cured cases, facial palsy was present in 8, that is 50 per cent.; in 6 of these 8, sequestra, involving the labyrinth more or less extensively, were present. In only 2 were there any symptoms, beyond the facial palsy, indicating that the labyrinth was involved. In these 2, intense headache, vomiting, and vertigo were present.

Of the 8 cured cases in which facial palsy was not present, in 4 a fistula of the external semicircular canal only was present; in the other 4 there was extensive caries, the cochlea and semicircular canals being more or less destroyed and replaced by granulation tissue. In only 2 out of this series of 8 cases were symptoms present. In 1 with a fistula only, there had been intense vertigo and incessant vomiting for five days, these symptoms passing off entirely after operation. In the other where extensive caries was present, vertigo had been very severe for twelve days and was entirely cured by operation.

Out of these 16 cases, only 1 was acute, and occurred in a child three months old. Very extensive caries was found, and the cervical glands were enormously enlarged. No tubercle bacilli

could be found, although the child's mother had died of acute phthisis one month after the child's birth.

Of the 11 fatal cases, cerebellar abscess was the cause of death in 4; and cerebellar abscess with meningitis in 2 others, that is to say, cerebellar abscess was present in 6 out of 11 fatal cases. In 2 meningitis was the cause of death, and in 1 meningitis with thrombosis of the lateral sinus. Two died of marasmus. In every case of this series the disease was chronic.

Facial palsy was present in 6 of these 11 fatal cases, that is 54 per cent. Of these 6, 3 had necrosis with formation of sequestra, and they were also cases of cerebellar abscess. In 1 there was extensive caries, and suppuration had extended through the internal auditory meatus, causing meningitis. In the remaining 2, marasmus was the cause of death, extensive caries of the labyrinth being present in both.

Of the 5 cases without facial palsy, necrosis with formation of sequestra was present in 2, and in both of these cerebellar abscess was present. In 2 the labyrinth was partially replaced by granulation tissue; in both of these meningitis was present, and in 1 there was also a cerebellar abscess; in this case the path of infection causing the meningitis could be through the internal auditory meatus. In the remaining 1 case an acute suppuration had apparently extended, two days before operation, through the fenestra ovalis, the labyrinth, and the internal auditory meatus, causing a general meningitis. There was no caries of the labyrinth itself, although the mastoid was extensively diseased.

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In only 1 of the 11 fatal cases were there any of the special symptoms of labyrinthine suppuration beyond the facial palsy present in 6. In this 1 case there was no facial palsy but intense vertigo relieved by operation; subsequently symptoms of cerebellar abscess developed, but operation was not successful. In 2 of the cases of cerebellar abscess there were no symptoms whatever, and death occurred suddenly and unexpectedly, while the wound, after the removal of the bone disease, was apparently following a normal course.

Of the total 27 cases, facial palsy was present in 14, vertigo in 5, no special symptoms whatever in 11. It is somewhat interesting to note that facial palsy only occurred fourteen times amongst the 691 cases apart from those associated with labyrinthine suppuration, and 8 of these were fatal cases; 1 died from sarcoma, 3 from meningitis, and 4 from tubercular meningitis or general tuberculosis.

Sequestra were found in 11 cases, 5 of which were fatal, all from cerebellar abscess.

With regard to age, 23 cases were between four and thirty-four; only 3 were under twelve months, of these 2 died of marasmus and 1 got well; 1 was 62 and is now getting well.

In only 1 case out of the 27 was there any probability of tubercle being the cause of the affection. In connection with this point, it is interesting to note that out of a series of 100 fatal cases of temporal bone disease, tubercle was only certainly present in 15, and in not one of these was the labyrinth affected.

Fatal intra-cranial complications occurred in 9 cases, 33 per cent.; of these 9, 6 died from cerebellar abscess, 22 per cent., and 3 from meningitis, 11 per cent.

Associated with this it is of interest to find that out of the same series of 100 fatal cases mentioned above, meningitis was the cause of death in 17, 3 of which were due to labyrinthine suppuration; cerebellar abscess in 18, in 6 of which the infection had passed through the labyrinth, and 5 through the lateral sinus, and in 7 through the area of bone lying between the sinus and the posterior semicircular canal. The importance of disease in the bone in this area, as being a point from which infection frequently spreads into the posterior fossa, has not in my opinion been sufficiently emphasised.

From a study of these statistics it is evident that extension of suppuration from the middle ear to the labyrinth is not infrequent, and is associated with a high degree of mortality. In all the fatal cases in this series, where intra-cranial complications were the cause of death, suppuration had extended backwards into the posterior fossa; in no case was the middle fossa invaded.

The treatment of these conditions must proceed on ordinary surgical lines, carious bone must be completely removed, even if large areas of the labyrinth are sacrificed. Sequestra should be removed if loose; if still fixed an attempt may be made to facilitate their removal by partial decalcification by the use of dilute nitric acid as suggested by Dr. Urban Pritchard.

Perhaps the most important point brought out by the study of these cases is the indication afforded of the best route for the exploration of the cerebellum when cerebellar abscess is suspected. After the radical operation has been performed the lateral sinus should be exposed, and, if found healthy, the bone between the sinus and the posterior semicircular canal should be removed, including any portions of the labyrinth which may be diseased.

After the dura mater in contact with this area has been incised, the abscess will be found in the immediate proximity, and may be readily opened and drained. It is often exceedingly difficult to

find the abscess if the cerebellum is explored through a separate trephine opening posterior to the lateral sinus, and if found it can only be drained through a considerable length of healthy brain tissue, which may readily become infected and spreading œdema set up.

The very high mortality of cerebellar abscess compared with that of temporo-sphenoidal abscess is probably to some extent accounted for by the difficulty experienced in finding and draining the abscess through a separate opening posterior to the lateral sinus.

SEVENTEENTH ORDINARY MEETING.

HELD IN THE HALL OF THE FACULTY OF PHYSICIANS AND SURGEONS, ST. VINCENT STREET, GLASGOW.

Saturday, May 21*st*, 1904.

THE PRESIDENT, DR. THOMAS BARR, IN THE CHAIR.

The PRESIDENT said: My first and most pleasant duty, speaking for my Glasgow colleagues and myself, is to offer you all a most hearty welcome to Glasgow. We have looked forward to this visit of the Otological Society of the United Kingdom with the greatest interest, and we are highly gratified to see so many gentlemen from a distance able to attend and honour us with their presence. I hope it will be a memorable meeting, not only by virtue of the work done, but also for the friendships formed. I am glad also to see gentlemen present who, although not members of the Society, have sympathy with our work, and who are specially interested in the topics we have to discuss to-day. I hope they will regard themselves for the time being as members of the Society and take part in the various discussions. There is one announcement I have to make with much regret, namely, that owing to illness Professor McKendrick will not be able to give us the demonstration which he so cordially promised. However, we are fortunate in that the Professor's senior assistant, Dr. Walter Colquhoun, has kindly agreed to act for the Professor. The demonstration in the University will be almost entirely of an experimental character, and is sure to prove a most interesting feature of our Glasgow Meeting. I shall not, gentlemen, detain you any further, and have now much pleasure in introducing to you Professor Cleland.

PROFESSOR CLELAND gave a demonstration *On the Development of the Mastoid and Tympanic Plate.*

Although the growth of the tympanic plate has at different times received attention from a number of observers, including Humphry, von Troltsch, Zuckerkandl, and Symington, the curious way in which it is developed seems scarcely even now to have come thoroughly home to anatomists, and may possibly in some points

not have come so explicitly as they might desire under the notice of the specialists whom I have the honour to address.

It will be recollected that at birth the internal and the middle ear, like the eyeball, have already advanced much nearer to their adult size than the parts around them. Thus the membrana tympani has already reached nearly its adult size. But the tympanic plate is at birth a mere ring, imperfect above, and adherent to the squamous by osseous union of the extremities bounding the open part of its circuit. It presents on the concavity of its curve a deep groove, just as in the adult, for the attachment of the membrana tympani, but is slender, extending neither outwards nor inwards beyond this groove; and in its position the tympanic membrane is much more nearly horizontal than afterwards, as, indeed, might be expected from the narrowness of the base of the infant skull as compared with the breadth of the brain above. At a later period the whole floor of the osseous portion of the external auditory passage is formed from bone growing from the tympanic ring and is roofed by the squamous, but there is no osseous portion of the external ear for some time after birth. At birth the whole cartilage of the external ear has much the form that it has in the adult, and is proportionate in size to the size of the skull. At its deep end the cartilage is attached superiorly to the squamous, close to the upper edge of the membrana tympani; but the diameter of the tube which it encloses being less than an eighth of an inch, its lumen is scarcely at all opposite that membrane, but suddenly expands into a fibrous sheet attached to the outer edge of the tympanic ring and lying face to face with the membrane, separated from it by only a narrow space. The hairs, which are abundant in the tube, filling its lumen, suddenly cease at the entrance into the flattened expansion opposite the membrana tympani, so that there is much protection to the young ear from violent sonorous vibrations. It often happens in preparing dried specimens of infantile skulls that the fibrous outer wall of the deep expansion or chamber of the external ear is left on accidentally and might pass for the bare membrana tympani were it not that a small opening is always to be seen at the upper and outer edge, and usually the membrana tympani will be found underneath it with the handle of the malleus in position.

Humphry, in his work on "The Skeleton," seems to have been the first distinctly to point out how the fibrous wall of this expansion becomes ossified. He writes (p. 266): "At birth we may commonly discern small dentated processes jutting out from the concave edge of the tympanic bone at its fore and hinder part. These pro-

cesses, growing beneath the membrana tympani, and approaching one another, shortly coalesce so as to form a more or less broad bar or plate, extending across the floor of the auditory passage." He then points out how there is at first left between the external auditory process thus developed and the lower edge of the tympanic ring, a gap of which a trace is sometimes found even in the adult. While, however, the story of the floor of the osseous external auditory passage is thus clearly told, the history of its roof seems to have been always left to the imagination. It is due to growth in breadth of the horizontal lower part of the squamous, accompanied by a diminution of obtuseness of the angle between that portion and the ascending scale from which the squamous takes its name. The adult form of the auditory passage is brought about partly by this means and partly by increase in diameter of its cartilaginous part.

Let us now study for a moment the growth of the mastoid process. At birth its tip alone is indicated by a minute tubercular elevation limited below by a short line; and this tubercle is so situated that a line continued back from the lower border of the zygoma would pass through it. Such a line would also touch the upper margin of the external auditory meatus. If between this line and that which is to be seen passing backwards and upwards from the upper margin of the zygoma the bone be cut into, a cavity will be opened to view, namely, the vestibule of the mastoid, roofed by the inwardly curving lower edge of the squamous bone, which slopes downwards as it passes forwards, leaving less and less of an "attic" above the malleus and incus. The posterior process of the incus is attached to the floor of the entrance into the vestibule at a point indistinguishable from the rest of the petro-mastoid with which it is now incorporated, but originally the root of the styloid process, and forming a bar continuous with the incus, as pointed out by me in Cleland and Mackay's "Human Anatomy." At this level at birth there is nothing to represent mastoid cells, but within two or three years a solid process projects downwards behind the auditory meatus, and not until a considerably later period do the mastoid cells begin to be hollowed out, while the process becomes swollen and ultimately reaches a distance half an inch or more below the floor of the meatus.

At birth the branches of the posterior auricular artery are close to the bone. In early years little grooves may often be seen where its branches are becoming imbedded in the new layers of osseous tissue which are being added superficially while absorption is going on within. As growth advances, irregular marks are left

on the mastoid process, especially on the anterior and lower part; and these are sometimes of a striking appearance, and have been mistaken for the remains of a line of union between the mastoid and a supposed descending process of the squamous. This, however, is a complete mistake. The squamous element while it is yet separable has a small projection straight backwards, beneath a slight notch which lies between it and the part of the posterior border which curves upwards. It is true that this process may increase in length and turn downwards, but not further than half way down the posterior wall of the meatus, and in close connection with the tympanic plate. The petro-mastoid is completely united with both squamous and tympanic long before the growth of the mastoid process is completed, and the marks referred to have nothing to do with the squamous element. They arise, no doubt, from the branches of the posterior auricular artery being buried in the additional layers added to the surface of the mastoid process, while the deep twigs have to supply the mucous membrane of the cells hollowed out in the interior.

The PRESIDENT said that he was sure the members had listened with great interest to Professor Cleland's exhaustive and valuable demonstration of the developmental processes connected with the temporal bone. The matters brought before the meeting by the learned Professor were not only of great anatomical interest, but they had a very practical bearing upon the surgical treatment of the temporal bone.

Dr. P. McBRIDE read a *Short Note on a Case of Cerebellar Abscess and Absence of the Mastoid Antrum.*

It must be considered doubtful whether, given a normal tympanum, it is possible for the mastoid antrum to be altogether absent *ab initio.* That it may vary in size within very wide limits is, of course, generally known. A careful perusal of current literature has, however, enabled me to find very little reference to obliteration of the antrum as a result of chronic middle ear suppuration. Indeed, the only absolutely definite statements I have been able to discover are from the pen of Trautmann ("Chirurgische Anatomie des Schlæfenbeins"). This author (p. 8) writes, "Even if the mastoid process is sclerosed to a great degree, so that the antrum has disappeared, the aditus remains," and again (p. 36) "The antrum may entirely disappear."

At the meeting of the Otological Society in May of last year,

Dr. Herbert Tilley related a case in which he operated and altogether failed to find a mastoid antrum. He again referred to this case at the meeting of the Society held on February 1 of this year, and the matter was once more under discussion in March, when Dr. H. E. Jones exhibited a temporal bone, in which the antrum was all but obliterated.

As the time at my disposal is so short I shall refer very briefly to the clinical features of the case which forms the basis of this communication and confine myself as far as possible to the—from the standpoint of this society—most interesting anatomical, or perhaps I should say pathological, condition which was found to exist.

I was summoned to see in consultation a young man who complained of headache, photophobia, and vomiting of a cerebral type. He had been giddy some days before, but this symptom was less marked when I saw him. The pulse was slow (48–56) and his temperature below 98°. There was an old standing middle ear suppuration on the left side. Examination of the eyes by an expert revealed nothing abnormal. It was determined to perform a radical mastoid operation as soon as practicable, as a preliminary step. This could only be arranged for twenty-four hours later, but prior to this the symptoms had somewhat improved.

The operation presented unusual difficulties. It was, of course, proposed to open up the middle ear cavities—in fact to perform what is known as the radical operation. The first difficulty encountered was the lateral sinus, which was exposed quite near the meatus. It is worthy of note that no pulsation was observed. Bleeding from the bone was quite unusually marked, indeed this hæmorrhage greatly delayed the successive steps of the operation. Owing to the position of the sinus it was determined to seek the antrum by Stacke's method. With this object in view, the outer wall of the attic was removed by means of a burr worked by an electric motor. When, however, I attempted to pass a protector into the aditus, I could find nothing but a small depression. I therefore arrived at the conclusion that there was no antrum, and was obliged to content myself with scraping out the tympanum, bringing away granulation tissue. No fœtor, however, was noticed. I then syringed with hydrogen peroxide which gave rise to bubbling. There was a little vomiting next day, but after that the patient was able to retain nourishment, was certainly better and only complained of headache, now more definitely occipital. Temperature and pulse continued subnormal, but it must be remembered that phenacetin, caffeine, and one or two

doses of salicylate were employed to relieve the pain. Curiously enough, the patient seemed to be capable of having his attention distracted from the pain. So much was this in evidence that it was thought possible that there might be an hysterical tendency. He also insisted upon lying with his occiput resting on his arms—a position which he said gave him relief. Everything seemed to be going well, excepting for the continuance of pain and subnormal temperature, until four days after he was first seen. At 4 p.m. the nurse noticed a slight incoherence and soon afterwards he passed urine and fæces in bed. It was thought well by his medical attendant and myself to have a further consultation. We therefore requested a physician who had been called in at the beginning of the illness and a surgeon to see the patient with us.

We all agreed that the probabilities were in favour of an intracranial abscess, but that localising symptoms were wanting. The patient now for the first time was rambling, and he several times jerked his right leg when disturbed. An examination of the eyes on this occasion revealed commencing choked disc on the left and hyperæmia of the disc on the right side. Both temperature and pulse had begun to rise for the first time after 4 p.m., and were respectively 99°F. and 60. The decision we came to was that if the symptoms did not improve next day we should trephine (1) over the temporo-sphenoidal lobe, (2) failing to find pus there explore the cerebellum.

Without any warning the next morning between four and five o'clock the nurse noticed a change in the breathing, and in a few minutes the patient was dead.

Autopsy by Dr. Shennan, Pathologist to the Royal Infirmary, revealed:

1. A very large abscess in the left lateral lobe of the cerebellum.

2. A small abscess in the inferior occipital lobe on the same side in contact with the tentorium.

3. Lateral sinus free from thrombosis.

4. Between the tegmen tympani and dura there was some pus.

5. The tegmen was enormously thickened—so much so that considerable force had to be used to make the chisel penetrate it.

6. There was no antrum at all.

7. The antrum on the other side was opened into and found to be small—about the size of a pea. No definite bone disease could be made out with the naked eye. A piece of bone was removed from the petrous portion by Dr. Shennan for microscopic examination.

The chief points of interest were—

1. "Spaces containing cellular vascular tissue, and in this, which is at parts necrotic, clumps of bacilli and cocci staining by Gram's method are to be made out, probably of pyogenic nature."

2. "A section from the neighbourhood of the tegmen tympani showed irregular spaces containing vascular young connective-tissue." (Dr. Shennan.)

The absence of the antrum is to us as otologists the most interesting feature of this case. Probably the cavity became gradually filled up by inflammatory growth of bone, similar to that which caused the marked thickening of the tegmen tympani. I must regret now that the portion of bone corresponding to the usual seat of the antrum was not removed for microscopic examination. Having read Trautmann's statement before referred to, I did not realise the extreme rarity of the condition before me, so far as the experience of others was concerned. True, I had not previously met with an instance of obliterated antrum, but until my attempt to find some account of the condition in other works, and until I had read and heard the discussions on the subject in this Society, I did not realise that my case was in certain respects almost unique. In conclusion, I desire to express my thanks to Dr. Shennan, Pathologist to the Royal Infirmary, for his kind assistance.

Mr. Arthur Cheatle thought it a very curious thing with reference to the absence of the antrum that although temporal bones had been examined for a great number of years, and although many hundreds were collected together in the Museum of the International Congress, there was not one instance of an absent antrum. All reported cases had been diagnosed during operation or without removal from the body. Without meaning any discourtesy to anyone, he refused to believe in absence of the antrum, apart from malformation of the middle ear, until a specimen was placed in his hands.

Dr. McBride, in answer to a question put by the President, said that the absence of the antrum was undoubtedly pathological.

The President said that in operating in these chronic cases associated with sclerotic bone, the antrum was found occasionally to be exceedingly small, although he was never satisfied that it was entirely absent or obliterated. In such cases, when the antrum is small and the bone sclerosed, the operator is sometimes confronted with much difficulty owing to the abnormally forward position of

the sigmoid part of the lateral sinus being right in the path of the operator in his search for the antrum.

Dr. URBAN PRITCHARD asked Dr. McBride to explain again how he failed to get the probe into an antrum. Did he think he got the probe into the attic?

Dr. McBRIDE replied yes.

Dr. PRITCHARD asked, then being satisfied that the probe went in the attic, how did he assure himself that the deeper part was not a small antrum? For the attic and antrum being continuous, the only way to tell the difference is by the smoothness of the walls of the former and the roughness of the wall of the latter cavity.

Dr. HERBERT TILLEY thought that Mr. Cheatle's refusal to believe in the absence of an antrum until he had cut sections of the temporal bone, in which such an abnormality occurred, was a scientific one, because without such an intimate examination it would be impossible to say that some small cavity was not present which would represent the antrum. With regard to his (the speaker's) own case, and to which reference had been made by Dr. McBride, he could only say that during the radical mastoid operation it was impossible to pass any probe from the attic tympani through the aditus and antrum, and the position of the latter was indicated by a small depression on the posterior aspect of the "attic." Furthermore, the bony wound which had been made in the search for the antrum had extended beyond the level of the "attic tympani." In such circumstances he felt justified in speaking of the absence of the antrum although he agreed that obliteration might possibly be open to less objection. He thought such an obliteration was quite a possibility, for it must have been within the experience of most present to have operated upon mastoids in which the antrum was a tiny cavity in which it would be impossible to place a small dried pea. The difference between such small antra and one entirely obliterated was surely only a question of degree. No arguments of any weight had been adduced to explain why there should not be defective development of the mastoid antrum; on the other hand, three or four cases had now been described where it was practically undeveloped or if originally present had become obliterated. The absence of the sphenoidal, the maxillary, and the frontal sinuses had occasionally been noted, but of course it was very rare, and the chances of any one individual coming across such abnormalities in actual practice were still rarer.

Mr. HUGH E. JONES remarked that one of the two specimens which he had shown at the last meeting was taken from the dissecting room and was not pathological so far as the ear was

concerned. In that specimen he was making an ordinary dissection of the tympanum and aditus and found that the short process of the incus was not lying in the entrance to the aditus, but below it, and that the latter passage was represented by a narrow tube of mucosa which led from the attic backwards, not to a definite antral cavity, but to break up at once into innumerable minute cells. There were a few fair-sized cells near the apex, but the rest of the mastoid was composed of dense bone or very minute cells. In this specimen the external meatus was unusually large, the mastoid relatively small, and the zygomatic ridge very well marked.

Dr. Kerr Love said he would like to put alongside Mr. Cheatle's experience, which was chiefly, he thought, from the anatomical standpoint, his own from the clinical standpoint. Ten years ago, when the radical operation was not so common as it now is, and when, for his part, he was chiefly doing partial operations, he believed in the absence of the mastoid antrum because on one or two occasions, during say the first fifty operations which he did, he could not find the antrum, but he now thought that in those cases he lacked boldness. If he had performed, as he now does, the radical operation in the more modern way, he would have found it. During the last 350 operations on the mastoid he had always found without fail the antrum, and yet he must admit that Dr. McBride's case is rendered conceivable by the smallness which the antrum is sometimes reduced to, he supposed by the encroachment of thickened bone on its various walls.

Mr. C. A. Ballance said he had no doubt that all would admit that any part of the body may be congenitally absent, and that the tympanum and antrum may be, and are in rare instances congenitally absent. This congenital absence of the tympano-antral cavities he did not think was of great interest to the Otological Society from the practical point of view, and that it was important for the Society not to lay stress on the question lest others outside the Society, less familiar with mastoid operations than his fellow members, should be led in difficult operations to use the excuse of an absent antrum for imperfect performance of these important operations. He had no doubt, however, that while congenital absence of antrum might be excluded as a practical question that pathological diminution of the size of the cavity, or even *almost* complete obliteration of the antral cavity, not unfrequently occurred as the result of the irritation of the purulent secretion producing outgrowths of bone, especially in sclerosed mastoids. He had many times known the neck of the antrum to be nearly occluded by an exostosis, and on several occasions the cavity of the antrum was

diminished so as to be of a very small size. He pointed out that the same process affected frequently the osseous meatus, and was familiar to surgeons in other parts of the body, as in the sclerosing ostitis of the head of the tibia after suppuration had ceased in that bone. There was one question he should like to ask Dr. McBride, and it was this: Why was he content to do only a mastoid operation when the symptoms pointed clearly to a gross intracranial lesion? How was it possible that the mastoid operation could save such a patient from impending death?

Dr. McBride said with regard to the points raised by Dr. Urban Pritchard and Mr. Cheatle, it seemed to him that these were of purely academic interest. If an antrum were so small that it could not be perceived post mortem with the naked eye, then he thought he was justified in considering it as absent, or, if they preferred it, obliterated. The antrum on the healthy side was found to be very small, and the thickening of the tegmen tympani described in the diseased ear, would suggest that a similar thickening had occurred above the antrum. With regard to the point raised by Mr. Ballance, he would remind him that at the beginning of his remarks he had definitely stated that he would not go over the clinical features of the case owing to the very short time at his disposal. At first, the patient presented all the features of a cerebral lesion without, however, any localising symptoms, and ophthalmoscopic examination revealed no changes in the discs. After this, however, improvement occurred, and after opening into the attic this improvement continued until the evening before death. He then had the advantage of a consultation with a physician and surgeon, and it was agreed that still no localising signs or symptoms existed, but that if on the next day there were no improvement an exploratory operation would be desirable. Time did not permit him to go into all the points which led to this conclusion, as that would involve reading that portion of his paper which he had purposely omitted. Even had the exact state of matters been known, it is improbable that a fatal result could have been avoided, as there were three distinct points of infection: (1) over the tegmen tympani; (2) in the occipital lobe; (3) in the cerebellum.

Mr. R. H. Parry read the notes of a *Case of Tinnitus and Vertigo Treated by Division of the Auditory Nerve.*

S. D——, aged thirty, engineer, was recommended for treatment in February, 1902, by Dr. Jones of Glasgow, who in his letter

expressed a hope that something might be done by operation to relieve his condition, as all other forms of treatment had failed.

The patient stated that he had enjoyed excellent health until six years ago, when one day he was suddenly seized with giddiness while he was lighting his pipe. He was not far from his house at the time and managed to stagger to it. While the attack was on him everything seemed to be turning round. During the next six months he had several such attacks, and he had finally to give up work for two years. The giddiness became more or less constant, affecting him more particularly when walking. He improved somewhat towards the end of that period, and was able to resume work and to remain at it for two years.

A year ago he was again obliged to give up work owing to the frequency of the attacks of vertigo. He complained of noises in the left ear, but only occasionally in the right. He had always been partially deaf in left ear, from which there had been a discharge until two years ago. There is no history of alcoholism or syphilis. During the three weeks in which he was under observation before operation his suffering remained as great as before admission; and it was made absolutely clear to us that he had in no way exaggerated his misery. He expressed anxiety to be relieved of the pain in the back of his head and the vertigo, which affected him both at rest and while walking about in the ward.

Three methods of treatment were discussed, and their relative value as affording the best prospects of relieving the pain, tinnitus and vertigo were carefully considered. Most of the drugs known to have any effect in relieving tinnitus had been tried with only unsatisfactory results, and so it was decided not to return to internal medications.

Ablation of the mastoid and semicircular canals was next considered, in view of the fact that there had been a discharge of pus from the left ear, and that under treatment for that the patient had for short periods found slight relief. The relief, however, was very temporary, and ultimately the treatment afforded him none.

The fact that a mastoid operation had not been carried out suggested that, in the opinion of the several medical men who had seen him, the seat of the trouble lay deeper, and that a simple mastoidectomy would not bring about the desired result. On the value of the removal of the semicircular canals no opinion could be offered, nor at the time (two years ago) could any information be obtained as to the probable effect of such a procedure.

As will have been gathered, this was a severe case of tinnitus,

and the effect of prolonged suffering had made the patient unwilling to submit to operative treatment which held out the prospect of only partial relief. The possibility that the condition might be dependent on a central cause, primary or secondary, was not overlooked, and it was agreed that if the patient remained unrelieved by division of the auditory nerve one would be justified in adopting this view; whereas, from the results of ablation of the mastoid and semicircular canals, such a conclusion could not be arrived at, as filaments of the nerve might still have been intact. It was hoped, in the first place, that division of the nerve would effect a cure, while if it failed to do so something would have been gained as to the seat of the irritation.

The evolution of the treatment of trigeminal neuralgia is instructive, and the present opinion is that in severe cases of that disease it is better to attack the nerve within the cranium rather than to divide its branches on the face. The analogy may be, and probably is, incomplete, but it is only right to record the basis upon which the treatment in this case was worked out.

The difficulties and risks attending the operation, together with the chance that it might not be effective in giving relief, were explained to the patient; he, however, expressed the desire that the attempt should be made, and accordingly the operation was carried out.

The question of the route by which the auditory nerve could be reached was next discussed. The three most feasible routes were through (*a*) mastoid, (*b*) posterior fossa, (*c*) middle fossa. The first would have involved an extensive bone operation, and would necessarily have been a long and tedious one to perform, while the danger of wounding the sinuses was a serious objection to it; also the presence of bone on the one side and dura mater on the other, made it practically impossible to retract the parts sufficiently to obtain the good view of the auditory nerve which was indispensable owing to its intimate relation to the seventh nerve. By the second route the dangers of wounding the sinuses were minimised, but on examination of the parts on the cadaver it was found that the auditory nerve was at a depth of an inch and a half from the trephine opening, which was made immediately below the curve of sigmoid sinus. The removal of bone in the direction of the foramen magnum did not materially shorten the distance from the occipital bone to the internal auditory meatus, while it tended to give a deeper wound, as measured from the skin, owing to the thickness of the soft tissues of the neck. In working at that distance from the surface, and with no definite landmarks as guides, it would have been necessary to considerably displace the left lobe

of the cerebellum in case of damage to the structures entering the jugular foramen. In the author's experience, in operation on the living subject, undue pressure on the cerebellum is attended with risks of laceration owing to the fact that it is maintained within a space the walls of which are rigid and unyielding. The third route, that through the middle fossa, was the one selected. The points in favour of it were that less difficulty was anticipated as regards hæmorrhage, that it was the shortest route to the external auditory meatus (an inch and a quarter from squamous bone), and that the parts could be better retracted, so affording a good working field.

The steps of the operation were as follows: A curved incision with the convexity upwards was made from the centre of the zygomatic arch to the base of the mastoid close to the parieto-squamosal suture. The squamous portion of the temporal bone was drilled in six places and the intervening bridges of bone divided with a Hay's saw. The bone was then raised with elevators, when the undivided portion fractured and so permitted an osteo-cutaneous flap to be turned downwards. The dura mater was separated from the surface of the petrous portion as far as the promontory caused by the superior semicircular canal. On removing the roof of the tympanic cavity an excellent view was obtained of that space, and it is interesting to note that it was possible by that method to determine the presence of pus or granulation tissue in the middle ear. More bone was removed in the direction of the mastoid antrum, but as no evidence of active disease was found either here or in the middle ear the fear that a septic focus had been left *en route* was set at rest. A plug of gauze steeped in 1:20 carbolic was introduced into the middle ear as a further preventive measure against infection of the wound. The dura mater was punctured to allow of the escape of cerebro-spinal fluid, thereby permitting of the better displacement of that membrane and the brain. The separation of the dura mater from the upper border of the petrous bone required considerable care, as it was here that some apprehension was felt as regards hæmorrhage. The superior petrosal sinus in the majority of the bones examined had been found to groove the outer half of the bone, while in the remainder the grooving was continued over the internal auditory meatus. To obviate, as far as possible, puncturing the sinus by raising it from the bone, the bone was divided and gently removed from it. The dura mater of the middle fossa, the tentorium, and the superior petrosal sinus were drawn aside by retractors. Some bleeding certainly took place from, I believe, some branches of the sinus,

but it was soon arrested by the pressure of small plugs of aseptic gauze. The roof of the internal auditory meatus was next removed, when the seventh and eighth nerves were easily recognised. The eighth nerve was drawn aside and could have been divided then, but owing, perhaps, to the fact that no untoward accident had occurred and to the desire to sever completely the vestibular and cochlear divisions, more bone was removed; but unfortunately, the detached portion proved to be the commencement of the Fallopian aqueduct, and in the withdrawal of it the seventh nerve was torn. This regrettable, and, it may be added, avoidable accident, permitted of a very thorough examination of the nerves in that opening. The plug was removed from the middle ear and iodoform gauze introduced in its place through the external meatus. The flap was then replaced and its edges sutured, except at the lower angles, where a strip of iodoform gauze served for drainage. The patient passed a restless night and complained that he felt giddy when he opened his eyes. Left facial paralysis was complete. During the following week he improved considerably, but the noises in the ear were present, although lessened in degree, and the vertigo persisted.

As regards the wound, it was completely healed on the tenth day, when the stitches were taken out. The temperature remained normal throughout.

For fully a month he was kept at rest, although in the third week he was most anxious to get up, declaring that he felt quite equal to it.

When allowed to move about again he still complained of giddiness and the noises in the head. The general opinion was that he was better, although, in his anxiety for a complete cure, we found it difficult to get him to admit it.

He reported himself at intervals of two months for about a year, and, although the symptoms had modified somewhat, they were still sufficiently in evidence to cause him considerable annoyance. At the end of that period he was induced to undergo a second operation in order to overcome the facial paralysis. The spinal accessory nerve was divided and attached to the facial close to the stylo-mastoid foramen. He has no voluntary power over the facial muscles; they move in association with the movements of the shoulder. He has been at work for some months since his last operation, but in respect of the three symptoms—pain, tinnitus, and vertigo—for which he was treated the operation has considerably relieved the two first, but not, to any extent, the third.

The present is, as far as can be ascertained, the first in which

the auditory nerve has been divided in the living subject. Two cases have been reported recently, but both ended fatally. It would be unwise to deduct too much from one case, but one may venture to hope that there are some points in this case of interest to both otologists and surgeons.

Dr. KERR LOVE said as the patient happened to be under his care before he went to the Victoria Infirmary he took this opportunity of throwing any light he could on the matter. He did not know the patient was coming before the meeting that day, or he would have had some notes of what took place in the Royal Infirmary, but he recognised the man at once, and his recollection was sufficiently clear to remember that he saw him at first in the dispensary, and that after considerable discussion he was admitted to the hospital so that his case might be inquired into. The idea he had was that some improvement in his condition might be made by removing the stapes and entering the internal ear. The operation, he thought, was refused by the man because he (Dr. Love) would not hold out definite prospect of recovery. The man, however, seems to have welcomed any operation by Mr. Parry which promised a reasonable chance of cure. He would suggest that any attempt to relieve the tinnitus and giddiness in such a case should not be done in this way. He thought that it was a most undesirable procedure. He thought that the internal ear should be approached through the middle ear, and that no attempt should be made to deal with the auditory nerve in a case like this unless there be present intracranial complications. No attempt on any account should be made to attack the auditory nerve in this way.

Mr. MACLEOD YEARSLEY said that he would like to ask what was the original condition of the man's hearing. He did not think the meeting had been told anything regarding it. He would also like to ask Dr. Parry why he had not contented himself with going into the internal ear without opening the skull at all, and removing the cochlea and the semi-circular canals. To his mind there were very grave doubts indeed as to the advisability of such an operation as they had heard described.

Mr. BALLANCE said that they were all familiar with the tinnitus vertigo and vomiting which might occur when suppuration of the tympano-antral cavities extended into the petrous, and that the proper treatment was not division of the auditory nerve but ablation of the petrous disease. He thought that there were cases where there was no infective disease of the petrous in which the

division of the auditory nerve would be the proper operation to carry out. This operation, he thought, should not be done by going through the petrous, but by opening the cerebellar fossa, displacing backwards the cerebellar hemisphere, and then dividing the auditory nerve with a hernia knife as it entered the internal auditory meatus. Experimentally the division of the auditory nerve produces in the monkey, he said, instability in walking, while slow destruction of the auditory by a tumour did not produce such results. He thought, therefore, that patients would soon recover from any symptoms of difficulty in walking after section of the auditory. With regard to facio-accessory anastomosis, he had had one case with complete recovery of dissociated movement in the paralysed face, but theoretical considerations seemed to point to facio-hypoglossal anastomosis as the proper operation to perform.

The PRESIDENT expressed the opinion that in this case it would have been desirable to have first performed the radical mastoid operation, because, when this patient attended the Western Infirmary there was a suppurative middle ear process, undoubtedly of a long-standing nature, and although it tended to dry up, under ordinary treatment, leaving a perforation, there was the possibility of the presence of cholesteatomatous masses in the antrum, which, by pressure, might account for the vertigo and the tinnitus. The President could not, however, quite agree with the complete condemnation of the operation expressed by Dr. Kerr Love because there were cases of violent and persistent tinnitus in which the operation of dividing the nerve might be justifiable experimental treatment; cases in which there had been no purulent affection of the ear and where the tinnitus had been utterly unbearable, and where there was good reason to believe that the lesion existed in the labyrinth and not in the intracranial cavity. In these circumstances if the surgeon believed the operation to be safe, and if all other treatment brought no relief, the division of the nerve might be tried as a last resource. But in such a case as this one, had the President's opinion been asked, he would have said, first examine by operation the spaces of the middle ear, the antrum, the cells, the attic—clear them out thoroughly if necessary; and also examine the labyrinth walls from the direction of the middle ear spaces and deal with any lesion which might be found there. If the results were negative, then the question of dividing the auditory nerve at the internal auditory meatus might be seriously considered.

Mr. RICHARD LAKE reported a *Case in which all the Semicircular Canals on one Side were removed for the Cure of Vertigo successfully.*

The patient was a woman of twenty-one years of age, who was the subject of attacks of aural vertigo, combined with sickness and vomiting, with gradually increasing deafness and tinnitus, the whole duration of the disease being five years. No cause could be found for the origin of the deafness.

During this period she had been subjected to long courses of treatment, both by careful dieting, and by the administration of various drugs of repute for the relief of these symptoms.

I saw her first six months before the operation which I am about to describe was performed. As she stated that she thought the use of her eyes in reading and in needlework tended to induce the attacks, she was examined at St. Thomas's Hospital by Mr. Fisher, who diagnosed slight hypertrophic astigmatism, and ordered her appropriate glasses, which she wore until a fortnight before the operation. She, however, stated that the use of these glasses made no difference as to the frequency of her attacks.

The attacks were heralded in usually by increased tinnitus, which not infrequently came on while she was lying down. The tinnitus persisted after the sickness and vertigo had ceased. She was unable to state that objects took any particular course during the attacks, or that she felt any tendency to fall in any particular direction.

During the six months when she may be considered to have been under my treatment, she was for some time given a drachm of quinine daily in three doses, each dose being administered with a drachm of hydrobromic acid. She also took iodide, strychnine, belladonna, and mercury; yet during this time not only did she obtain no relief, but her attacks increased in frequency, often recurring after an interval of only one day, though for the last two years and more she had never been free from an attack for a period of more than two months. As a last final attempt to obtain relief before having resort to an operation, which at the best could only be based on theory, she was taken into hospital, and treated with hypodermic injections of pilocarpine. During these two weeks she had several attacks of vertigo.

The examination of the ear gave the following results:—

Acoumeter in concha. Voice was heard at two feet. Whisper not heard. Rinne's test with forks C and C^2 were negative. C. mastoid — 30 secs., C^2 — 16 secs. Tests with tuning forks 3 C, 2C, 1C, C were not heard. C^1 — 50 secs., C^2 — 40 secs., C^3 — 30 secs., C^4 — 25 secs.

On February 16 of this year she was anæsthetised, and an ordinary radical mastoid operation was performed, with the exception that the innermost portion of the posterior wall was not removed, but the bony opening in the temporal bone was enlarged, both forwards, upwards, and backwards. Anteriorly it was extended into the base of the zygomatic process of the temporal bone, and postero-superiorly in such a way that the long diameter of the bony wound was from above downwards and forwards. The malleus and incus lying exposed after the removal of the external attic wall were removed. At this period of the operation the burr was substituted for the cutting gouge which had been previously employed.

The next step in the operation consisted in exposing the upper and outer surfaces of the external semicircular canal in its whole extent. The antero-external portion of this canal was now followed forwards and inwards until the outer surface of the superior canal was brought into view. The whole of this canal was then removed by cutting it away with a medium-sized burr, leaving only the upper part of the arch, or fornix, untouched. The posterior rim of the external canal was then followed, so as to bring into view the posterior canal, which was burred away entirely. A large oval burr was now substituted for the medium-sized burr previously used, and the upper surface of the external—the only remaining—canal was cut away with the burr until the anterior half of the membranous canal was exposed. This was then removed with a small burr, which was then employed to make a medium-sized opening into the vestibule, and an attempt was made to clear away the crista acoustica at that end of the canal. This completed the operation.

The wound was then swabbed out with Lister's strong solution, a precaution which I considered to be necessary to adopt, on account of the impossibility of carrying out our operative procedures under strict antiseptic precautions. The external meatus was divided longitudinally through its posterior wall, and the wound packed and closed by the ordinary methods.

Immediately after the operation the patient suffered very severely from shock, which lasted for about one hour. Slight chloroform sickness supervened, but this was certainly hardly so much as is commonly the case. For the next forty-eight hours the patient lay coiled up on the right side, her thighs flexed on the abdomen, and the legs on the thighs, in the typical position commonly described as that due to cerebral irritation. During this period her eyes were tightly closed, but beneath the lids one

could see that there were erratic movements of the eyeballs, and she resented any attempt to raise the lids; but though the light from the window fell directly on her face, she preferred not to have the window darkened.

On the third day the wound was dressed, and she would open her eyes if asked to do so, but preferred to keep them shut. When they were opened the eyeballs were subject to irregular rhythmical movements, both upwards and downwards and laterally.

On the seventh day she sat up; on the tenth day she was able to walk with assistance for a few steps, and on the fourteenth day she could walk easily from the small room in which she was into that adjoining, a matter of some fifteen to twenty feet there and back. She could, however, only turn towards the right or sound side. If she turned to the left, she would have fallen over towards the right side.

On the sixteenth day she walked downstairs with a little assistance, and upstairs without any. Her symptoms from that time lessened day by day.

At the end of four weeks she was able to do everything without any fear of falling. Since the fourth day there had been no movements of the eyes, nor could any optic movements be induced, either by syringing the wound with hot or cold lotions.

It is now fourteen weeks, or slightly over three months since the operation. There has been no return of vertigo, and the patient is enjoying better health than she has done for the last few years.

There are a few points in respect to this case which are worth considering.

The first is naturally the indication for operation. That can only be arrived at with anything approaching certainty when one has more than one case to consider. Those cases which would appear to me to be the most suitable are those in which, by a careful examination, and after a course of treatment, one has proved that the vertigo cannot be controlled, and at the same time that the deafness is sufficiently great to admit of no reasonable hope of alleviation, although, as will be seen when one comes to consider the question of tinnitus, the hearing does not appear to be materially diminished, and indeed the reverse was noticed in this case.

The operation itself is one in which the difficulties will be largely due to anatomical irregularities and the age of the patient. In those skulls in which the middle fossa is at a lower level than the semicircular canals, the operation would of necessity be more difficult and tedious.

With regard to the age of the patient, all patients, excepting those who have passed middle age, have a dense petrous bone, and the definition of the canals is extremely difficult.

With regard to the symptoms following operation, it is impossible to avoid the conclusion that the extreme shock and irregular movements of the eyes were not entirely disconnected with the use of Lister's strong solution, for we are aware that irritation of the canals causes graver symptoms than simple section, and I would go so far as to say that strong and irritant antiseptics should not be employed.

Finally, with regard to the tinnitus and the hearing power. The former was absolutely uninfluenced by the operation, that is to say, her tinnitus is still as bad as it was before. The hearing power, however, underwent a most extraordinary change. The voice, which had only been heard before the operation at two feet, was now well heard at five feet. Her bone conduction, which had previously been minus 30 secs., was now minus 25 secs., but whereas she had heard the C^1 tuning fork, although very badly, before, she was unable to detect it by air conduction afterwards.

Mr. CHEATLE said he wished to give Mr. Lake his hearty congratulation on this most important case. It was, as far as he knew, the first operation carried out on the labyrinth apart from suppuration with success. Mr. Cheatle mentioned that he had suggested opening the labyrinth for Ménière's disease many years ago (*Arch. of Otol.*, vol. xxvi.).

Dr. W. MILLIGAN said that he heartily joined in the congratulations accorded to Mr. Lake. He thought that there was a distinct field for operation in such cases. In the early part of last year he had operated in a similar case, and had removed the semicircular canals with complete success so far as the patient's vertiginous symptoms were concerned. The tinnitus had, however, not completely disappeared. The patient, owing to constant attacks of vertigo, was unable to follow his occupation, and in the circumstances he had considered operative interference justifiable. Since then he had operated upon two similar cases, one with success, the other without success.

Mr. LAKE stated, in reply, that the tinnitus was not influenced at all.

Dr. J. H. NICOLL read a paper on *The Indications for Operative Procedures upon the Lateral Sinus and Internal Jugular Vein, with illustrative Cases.*

The circumstances in which operations on the lateral sinus and jugular vein are called for concern the general surgeon and the otologist. They constitute a wide field in operative surgery, presenting numerous cases in which the interests of the patient are best served by the co-operation of the specialist and the general surgeon.

Either vessel may demand attention on account of some affection peculiar to itself. On the other hand, operation may be necessary in either because of some affection of the other.

The operations performed may be tabulated as follows:

The Sinus.

(*a*) *Operative interference on account of some involvement of the walls or contents of the sinus itself.*—Such involvement, while frequently suspected from the symptoms presented, is, as a rule, demonstrated in the course of a radical mastoidectomy. The treatment necessary is so well established in otological practice that, were it not for the directions given in a number of works on general and operative surgery, reference to the matter might be omitted. It may be well, however, to emphasise the rule that, given a sinus opened for infective thrombosis in the sigmoid region, the exposure and opening of the vessel must be continued until the end of the thrombus is reached. Such has been the routine practice of otologists for years, and in a number of cases the resulting operation has exposed the sinus as far as the torcular. The removal of the whole of the infective thrombus constitutes the patient's main chance of escaping general pyæmic dissemination. Further, even when such has already occurred, the removal of the thrombus cuts off the supply of pyogenic emboli, and the result may be recovery, as in the case of a patient present, the particulars of whose case are recorded in the last edition of Barr's "Diseases of the Ear." In this case Dr. Barr and myself removed the thrombus extending from sigmoid to torcular (tying the jugular also in the neck), after the patient had developed pyæmic pulmonary abscess, with ultimate recovery.

(*b*) *Operative interference with the sinus on account of some affection of the jugular vein.*—These cases concern the general surgeon rather than the otologist. Two typical cases will indicate the scope of surgery in this direction:—

(1) J. C——, aged ten, shown to the Society to-day. Seven months ago, while clearing out caseating tubercular glands from her neck, in which the tissues were "massed" by dense periadenitic induration, I accidentally tore the jugular so close to

the base of the skull that ligature proved impracticable and packing insufficient. I therefore opened the mastoid process (avoiding the antrum), exposed the sigmoid sinus, and, with the *point d'appui* furnished by the skull, readily controlled the hæmorrhage in the neck by packing the sinus. That measure I had previously carried out in other cases.

(2) Case of a patient with malignant disease of the tonsil and fauces implicating the lateral pharyngeal wall. In this case, operated on nine years ago, the common carotid artery was ligatured as a preliminary step, and, at the same time, the venous channel was abolished by tying the jugular and opening and packing the sigmoid sinus in the skull. Ten days later I attempted to resect the cancerous mass. The operation was abandoned owing to the arterial conditions. The external carotid and its lingual and facial branches were found to be thrombotic. The internal carotid, however, contained fluid blood and presented the arterial pulse transmitted by the circle of Willis. The venous channel was found to be impervious and thrombosed.

The Internal Jugular Vein.

(*a*) *Operative interference on account of some affection implicating the vein itself.*—Of diseases involving the vein that most frequently found is some affection of the deeper cervical lymphatic glands, in which tuberculosis, pyogenic inflammation, carcinoma, and lymphadenoma are common. Operations for the treatment of such conditions constantly present to the surgeon one or other of two contingencies, in which it is necessary to deal with the internal jugular vein:

(1) Accidental wound of the vein or of one of its main entering tributaries. In such event, in a case with much periadenitic induration, the finding and ligaturing of the vessel may prove a task of no little difficulty. The old surgical rule, that that which cannot be secured and safely left should be removed, suggests the obvious course of extending the skin incision and applying ligatures to the vein at points where the anatomical relations of parts can be made out above and below the indurated area where the wound occurred, with removal of the intervening portion of the vein *en masse* with the adherent glands. Should, however, the patient be a girl, to whose parents the surgeon has optimistically spoken of "tunnelling" out the glands through a skin incision of "one inch," he is occasionally tempted to abandon procedure *secundum artem*, and to trust to that "fate" which has been declared to be "ever better than design." Whatever her power in affairs in general, it may be

conceded that, when fate assumes the form of a competent nurse, and her thread that of a strip of gauze packing, the ultimate result is frequently better than that of the more surgically correct formal procedure.

(2) Involvement of the vein in the glandular mass of so intimate a character that attempted freeing would appear to be futile. In such a case removal of several inches of the vein *en masse* with the glands is deliberately included in the design of the operation. In the specimen shown to the Society the mass of glands surrounding the vein removed happens to be tubercular. The operation is more frequently called for in the case of carcinomatous and lymph-adenomatous glands.

(*b*) *Operative interference with the vein on account of some disease affecting the sinus.*—The jugular vein may be dealt with in an emergency, or its closure may be a feature in a deliberately planned operation.

(1) Emergency.—Accidental wounding of the sigmoid sinus is not infrequent in the course of radical mastoidectomy. The resulting hæmorrhage obscures the operation field, and may amount to a serious loss before the end of the operation. Ligature of the vein largely reduces the hæmorrhage, checking all flow from the lower end of the divided sinus—a flow which may become enormous in any respiratory difficulty under anæsthetic and during the vomiting of recovery.

Ligature of the vein in such emergency secures the patient, further, against the risk of pyæmia through respiratory aspiration into the wound in the sinus of pyogenic material dislodged in the further course of the mastoidectomy.

Accidental wounding of the sinus may occur also during the subsequent dressing of the mastoidectomy cavity, as in one of the cases shown to the Society.

A. U——, aged five, radical mastoidectomy, August, 1900, for tubercular disease of the middle ear and mastoid. Extensive carionecrosis of mastoid dealt with, and sinus freely exposed in consequence. Three weeks later, during re-introduction of the gauze packing, the sinus was lacerated by the probe. The jugular was tied in the neck and the packing secured in the mastoidectomy cavity by sutures through the skin.

(2) Ligature or excision of the jugular vein as an operation deliberately planned.—In cases of infective sinus thrombosis it is an essential that, so far as the main channel at least is concerned, the end of the thrombus be reached. This involves following the intra-cranial channel to the torcular or further, and the inspection of

the jugular vein in the neck, with ligature or excision, in some cases as low as the first rib. Measures thus indicated for the vein commonly constitute a feature in the operation on the sinus, and the work of Horsley, Ballance, and others places the obliteration of the jugular vein in the position of the natural termination of a mastoidectomy in which the sinus has been found involved, or of a measure to be carried out at a subsequent early operation. In such a case co-operation between otologist and surgeon is in the patient's interests, if for no other reason than that a resection of the jugular is not a measure to be undertaken by the same fingers and instruments as have just left a septic mastoid antrum.

Ligature or resection of the jugular vein as a preliminary to mastoidectomy.—For some years I have made it a routine practice, in two classes of cases, to deal with the jugular vein in the first instance as a preliminary to mastoidectomy. These cases are:—

(1) Cases in which the ear and mastoid disease has produced secondary mischief in the cervical glands. Such cases, so far as my experience goes, are more common in children than in adults. Further, the mastoid affection is commonly of tubercular nature, with carionecrosis of the mastoid, often extensive, and necessitating in consequence more than one operation to complete the cure. In such cases the glands are removed from the neck and the jugular vein dealt with as the first step in the radical mastoid operation.

Three of the cases shown to the Society were thus dealt with:—J. G——, aged three, operation 1902, and J. D——, aged seven, operation 1901, were affected on one side only. They are both soundly cured, apparently, and have been selected as illustrating also the two common results of healing after mastoidectomy of a radical kind in which no grafting was employed. In the case of J. G—— the cavity has quite closed, and the evidence of the mastoidectomy consists in the crescentic scar behind the auricle. In the case of J. D—— there remains a cavity of the size of a sparrow's egg, or larger. This has become completely "papered" by an ingrowth of epidermis from the margins, and communicates freely with the middle ear. In this case the result entails this disadvantage to the boy, who is now at school, that when his bigger schoolmates are idle they capture him, fill the cavity with earth, and implant therein a spent lucifer match, which he is forbidden to remove on pain of dire consequences.

The third case, J. M——, aged fourteen, is shown as illustrating the results of such treatment carried out on both sides, the right in 1900 and the left in 1903.

(2) Cases in which no glandular affection exists, but in which

there is reason to suspect either actual sinus involvement or such an extent of carious mischief as will probably necessitate exposure of the sigmoid curve of the sinus. The latter cases not infrequently demand repeated operation for removal of carious bone. In such cases the jugular is ligatured as the first step in operative treatment. Two of the cases shown belong to this category:—

H. N——, aged three, operation 1902, has been selected as illustrating cure attained after three operations for removal of caries. The amount of bone removed may be judged by the size of the skin-"papered" cavity behind the auricle.

M. G——, aged five, has been selected for two reasons. The disease, and consequent operation, were bilateral. Both sides have been operated on for caries on several occasions. In neither side, however, has cure yet been attained. In such a case preliminary ligature of the jugular is in some degree a safeguard against hæmorrhage from accidental wounding of the exposed sinus in repeated operations, or in course of prolonged dressing by packing (*vide supra*—Case of A. U——). It is also a safeguard against general hæmatogenous infection of tubercular or pyogenic nature.

Preliminary obliteration of the venous channel may be made more complete, as the following case illustrates:—

M. S——, aged sixteen, operation 1901, symptoms of acute mastoid empyema with probable sinus thrombosis. Ligature of jugular vein at level of sixth cervical vertebra. Exposure of lateral sinus midway between sigmoid and torcular; opening of sinus and occlusion by packing. Neck wound accurately closed by suture. Scalp wound temporarily closed by suture over the packing in the small trephine aperture in the skull. Both wounds covered by iodoform collodion. Radical mastoidectomy—purulent contents cleared from antrum and attic; sinus exposed at sigmoid curve, apparently healthy, and not dealt with. Uneventful recovery. Packing in mastoid cavity renewed daily. On fourth day mastoid cavity appeared dry—wound over trephine aperture for lateral sinus therefore re-opened and packing in sinus groove changed. Both mastoid and sinus wounds re-packed daily till tenth day, when the latter was finally closed by suture.

Preliminary abolition of the venous current by means of ligature or resection of the internal jugular, with or without closure of the lateral sinus, is an operation which, with ordinary aseptic technique, presents risks which may be regarded as trivial. Its advantages are:—

(1) That, as the initial step in the operative treatment, or as a distinct preliminary operation, it is performed by clean hands and

instruments, and not by hands and instruments soiled by the septic contents of the mastoid cavity previously dealt with.

(2) That the incision necessary may be utilised for the removal of infected cervical glands.

(3) That in cases in which, on exposing the sigmoid sinus in the course of a mastoidectomy, the discovery of presumptive evidence of infective thrombosis leads to the opening of the sinus and the demonstration of the thrombus (often in the shape of flocculent patches along one wall only), ligature of the jugular carried out then may prove futile in preventing pyæmic dissemination. In such a case the disturbance of the sinus wall, in its exposure, palpation and opening up, will have gone far to dislodge portions of the septic thrombus into the venous channel patent to the general circulation. Preliminary ligature obviates such risk.

The PRESIDENT thanked Dr. Nicoll for his suggestive paper, and referred to the importance of the question as to whether the internal jugular vein should, in these cases of septic thrombosis of the lateral sinus, be ligatured *before* or *after* operation on the mastoid and the sigmoid part of the lateral sinus. Dr. Nicoll's opinion on this matter was of great value as formed after very unusual experience.

The PRESIDENT at this stage expressed regret that the forenoon's work must come to an end in order that the members might be in time for the demonstration at the University. He added, however, that the remaining communications would be taken as read and be published in the *Transactions*.

RECENT PHYSICAL RESEARCHES ON THE NATURE OF VOWEL TONES IN REGARD TO THEIR BEARING ON MOVEMENTS OF THE TYMPANIC MEMBRANE.

A Lecture delivered on May 21, 1904, to the Otological Society of the United Kingdom in the Class Room of Physiology of the University of Glasgow for JOHN G. MCKENDRICK, M.D., LL.D., F.R.S.,

BY WALTER COLQUHOUN, M.A., M.B., F.R.S.E.

MR. PRESIDENT, GENTLEMEN,—In the name of Professor McKendrick I bid you welcome to this class room in which for nearly thirty years he has, by the brightness of his lectures and his enthusiasm for his subject, exercised a considerable influence for good on those preparing to enter the medical profession. I am very sorry that he is not here to-day to address you on the branch of his

subject to which he has devoted the interest of a lifetime. I am sure that you will join me in wishing that he may have a speedy recovery and that in his absence you will be indulgent to me who endeavours to take his place.

At first sight, gentlemen, it may not be very apparent to you what a meeting of the Otological Society has to do with researches on vowel tones, but I hope that, after a simple statement of the problems of which a solution was attempted, you will agree that the subject is of considerable interest to you. Long before the capabilities of a ferrotype or of a glass plate had been demonstrated it was a source of admiration that a single membrane such as the tympanic membrane could transmit vibrations leading to such varied perceptions as those of pitch, quality, harmony, proper sequence, and speech. The admiration was not lessened by the consideration that the human race has been profoundly affected through its emotions by the vibrations of the tympanic membrane, whether due to the resonant periods of the orator, to martial music, to love ditties, or to funeral dirges. Indeed, so great has been the demand for this influence, which is usually described as beneficent, that from early times those who could most skilfully invent and transmit the necessary vibrations have been segregated into an honourable profession. The composer of music works by rules which have been elaborated during centuries, and even at the present day the scientist is not absolutely certain that he understands the elements of the subject. Thus we cannot state mathematically the conditions necessary to produce a certain quality of sound. We cannot answer with certainty the questions, "What is it which makes the vowels distinguishable when sung on the same pitch?" "How is it that *o* has always the peculiar character of *o*, and *i* has the peculiar character of *i* when sung at the same pitch?"

Before beginning the discussion of pitch and quality I recall to you the nature of sound waves by showing you one of Crova's discs. As you remember, we have to do with the propagation of alternate condensations and rarefactions of the atmosphere produced by the vibrations of a sonorous body. We may consider the effect on the tympanic membrane as a series of rhythmic impulses. Now the question of pitch appears easily answered. I have here a tuning fork which gives fifty double vibrations per second. If I attach a bristle to one prong I can obtain, by bringing the bristle into contact with the smoked surface of a revolving drum, a record of the vibrations. I can thus assure myself by this method that the octave of the note sounded by

another fork gives double the number of vibrations. We know that pitch depends upon such conditions as size of fork, length of string, tension of string, length of tube, etc., and we can so arrange our apparatus that we can obtain a note of any desired pitch. But one question remains unanswered even by the graphic record on the smoked cylinder. "How is it that the same note sounded on different instruments, as, for example, the flute, cornet, trombone, or the violin, can always be distinguished?" We speak of certain notes as rich, pure, brassy, etc. What constitutes the difference between sounds due presumably to the same number of vibrations per second? One fancies, as did Helmholtz, that the answer to this question will also answer the question already propounded: "How is it that we can always distinguish the vowels when they are sung on the same note?" Looking to the history of the subject it is found that the first efforts towards the solution of the problem were synthetic.

Kratzenstein and Kempelen, about 1770, attempted to artificially imitate vocal tones, and produced so-called speaking machines but they did not establish general principles.

Robert Willis, in 1833, in his "Lectures on Acoustics," stated, "A given vowel is merely a rapid repetition of its given note," and "The partial characteristic of a vowel is independent of the fundamental tone." In the experiments in which Willis imitated vowel tones, he used reeds with varying lengths of tubes acting as resonators. I repeat some of his experiments. You observe that this reed pipe gives the sound *a* (ah). When I place a resonating cavity above it formed of a cylindrical cardboard box with a round hole in the upper end the sound is changed to *o*. Another resonator having a lip-like protrusion gives *ou*.

Wheatstone, in the *Westminster Review*, 1837, made some excellent suggestions about the nature of vowels and consonants. He wrote that vowels are produced in the larynx and that the cavities above resonate and give quality to the sound.

Donders, by whispering the vowels, showed that the cavity of the mouth, as arranged for giving forth a vowel, was tuned as a resonator for a tone of a certain pitch, and that the forms of the cavity when adjusted for different vowels resonated to notes of different pitch.

The problem was next attacked by Helmholtz, both analytically and synthetically. He analysed the tones of musical instruments and also vowel tones and attempted to reproduce them. I demonstrate to you first the change of quality obtained by adding various partials to a fundamental note. I have here eight forks, *si*$_2$flat,

si$_3$flat, *fa*$_4$, *si*$_4$flat, *re*$_5$, *fa*$_5$, *la*$_5$flat, *si*$_5$flat, the numbers expressing the frequency of vibration of the last seven being multiples in numerical order of that of the first or fundamental note. You observe that when I sound the fundamental along with any of its partials I change its quality, and that the upper partials especially add brilliancy to the tone. Helmholtz asserted that *ou* was given by the fundamental alone. *O* was obtained by sounding the fundamental moderate, the first partial strong, and the second weak, and so on for the other vowels. With practice, an appreciation of vowel qualities is attained in these experiments, but it cannot be said that the imitation of vowels by means of combinations of tuning forks is very successful.

To analyse the sounds of musical instruments or of vowel tones, Helmholtz used a series of forks whose frequencies were in the ratios 1 : 2 : 3 : 4, etc., each having a cylindrical resonator of corresponding frequency behind it. Each resonator is closed by a disc and can be opened at will by pressing down a key. The forks are kept vibrating by momentary electric currents passing around electromagnets close to their prongs. The interrupting fork, which I tuned carefully to unison with the lowest fork of the series, is in the next room. As you observe, the vibrations of the forks are hardly heard, but if I open the resonator opposite any one of them, it at once responds to its fork and sings out. The experiment shows that a whole series of forks can be kept vibrating by making electromagnets with a frequency equal to that of the lowest fork of the series. It suggests that the note of the lowest fork sounded on, say the trumpet, would influence all the resonators. Such indeed was found to be the case, and by opening succeeding resonators it could be observed which responded most loudly. In this way the chief partials which lend quality to a sound could be picked out. The sound could afterwards be reconstructed by setting the forks vibrating by the interrupted currents and opening the proper resonators.

These investigations led Helmholtz to put forward his first theory, which was that, as in all musical instruments, the quality or timbre of the vowel depends on the fundamental tone reinforced by certain partials or overtones, which are produced by the vocal cords along with the fundamental tone, the reinforcement depending on the resonance of the cavities above the vocal cords.

This theory was upset by an observation of Donders and Marey, in using the phonograph to reproduce vowel tones. If a vowel is sung to the phonograph while the cylinder is travelling at a certain speed, the vowel tone will be reproduced with exactly the same

quality if the cylinder is driven at the same speed; but if it is driven faster the quality of the vowel will be changed, so much as to be scarcely recognisable. This led Helmholtz to advance a second theory as follows:—"Vowel qualities of tone consequently are essentially distinguished from the tones of most other musical instruments by the fact that the loudness of their partial tones does not depend upon the numerical order, but upon the absolute pitch of those partials; thus when I sing the vowel A to the note E flat, the reinforced tone *b* flat is the twelfth partial tone of the compound; and when I sing the same vowel A to the note *b* flat, the reinforced tone is still *b* flat, but is now the second partial of the compound tone sung." That is to say, that each vowel is characterised by a certain harmonic or partial tone of fixed pitch, whatever be the pitch of the note on which the vowel was sung. Helmholtz next attempted to discover the pitch of the mouth cavity as a resonance cavity when formed for the pronunciation of certain vowels. I have here Helmholtz's forks. I take up the *O* fork, strike it on my knee, and bring it close to my mouth which is in the form for pronouncing *O*. You hardly hear the fork until it is before the mouth cavity, which at once reinforces the sound. He stated his conclusions, "The pitch of the strongest resonance of the oral cavity depends solely upon the vowel for pronouncing which the mouth has been arranged."

König also investigated the pitch and form of vibration due to vowel sounds by his well known manometric flame apparatus. In the slides which I show you, of flame pictures of vowels, each little elevation may be considered as due to a slight increase of pressure. You observe that the elevations are grouped into periods, as if at regular intervals the vibrating membrane in contact with the gas took a longer swing, still keeping up the lesser vibrations.

It is very necessary to bear in mind, when examining graphic representations of compound vibrations, that wave form alters very much according to phase, and that the human ear is incapable of distinguishing phase. Thus if I sound the same two tuning forks, the sensation from the compound tone is always the same, and yet the tracings or graphic representations of the compound wave would be identical on different occasions only by chance. Thus the waves from the second fork might start at the same time as those from the first, or they might start half a period behind. The compound waves in the two cases, would appear different in graphic representation. I show you on the screen the forms of the compound waves obtained by combining, given simple waves (1) when the latter start at the same phase; (2) when they start at different phases.

I take up now more in detail, and in historical order, the attempts to obtain graphic records of vibrations causing sound:—

In 1807 Thomas Young obtained tracings, familiar to every medical man, of the movements of the prongs of a tuning fork.

In 1856 Leon Scott invented the phonautograph, which consisted of a paraboloid resonator closed at the smaller end by a membrane to which a light lever was attached carrying a writing point. When notes were sung into the open end of the resonator the membrane was set vibrating, and tracings of the movements of the lever's end were taken on a smoked cylinder which rotated on a screwed axis, thus providing for lateral movement and a continuous tracing.

In 1864 König investigated compound tones by his manometric flame apparatus.

In 1874 Barlow invented the logograph—an improved phonautograph.

In 1877 Edison invented the phonograph.

The phonograph was of enormous interest to those engaged in this branch of research, and it should be of equal interest to otologists. I pointed out early in the lecture that, before the capabilities of a ferrotype or of a glass plate were discovered, it was a source of admiration that the tympanic membrane could transmit all the variations and inflections of the human voice.

We are accustomed to associate one note of definite pitch and of definite quality to a certain known mass of material vibrating under definite conditions. How wonderful did it appear, therefore, when it was found that a ferrotype or a glass plate could be made to take up and record all the complex tones of the human voice or of a band and reproduce them again faithfully! Here we seemed to have found at last a method of accurately investigating the difficult subject of the nature of vowel tones.

A point of interest to otologists is that the ferrotype or the glass plate of a phonograph or of a telephone is in a state of tension, and is thus more ready to spring to respond to vibrations differing greatly in frequency as do those of a compound tone.

I show you a model on a large scale of the phonograph disc with the heavy horseshoe disc which keeps the plate in a state of tension and the blunt reproducing point. In taking a record on the wax cylinder a small, sharp chisel replaces the blunt reproducing point, and when the sound waves set the disc vibrating the fine chisel point cuts grooves in the revolving wax cylinder. The

disc, while keeping up its fine vibrations, which cause a succession of pits in the bottom of the groove, swings more or less, thus causing the groove to be deeper at one point than at another, a section along the groove having the appearance of the wooden model lying on the lecture table.

Immediately following the invention of the phonograph the method of Fourierian analysis was applied in 1878 to the investigation of the waves, and it was shown how to break up mathematically a compound wave into its simpler elements. This method lent additional zest to the researches of those who hoped to solve the problem of the cause of the production of vowel tones by a study of the marks on the phonograph cylinder, because by this mode of analysis it was possible to determine the relative intensities of the partials existing in the compound wave.

Fleeming, Jenkin, and Ewing used the Fourierian method to analyse curves obtained from the tinfoil phonograph.

In 1890 Hermann obtained photographs of the movements of a beam of light reflected from a mirror resting, by a mechanical device, on the vibrating disc of the phonograph.

In 1891, Boeke measured microscopically the breadths of the marks on the surface of the wax cylinder, and from the measurements inferred their depths, thus being able to reconstruct for Fourierian analysis the curves on the surface of the cylinder with considerable accuracy.

In 1895, McKendrick photographed the marks on the surface of the cylinder of the phonograph, and in 1896, by the application of the principle of Lord Kelvin's syphon recorder to the phonograph (a method, however, previously used by Jenkin and Ewing), he was able to obtain tracings of the curves on the surface of the cylinder on a large scale.

I show you a large model of the syphon recorder, and Mr. Paterson, of Messrs. Kelvin and White, shows you McKendrick's phonograph recorder in action. Six inches of tape in this recorder represent an interval of $\frac{1}{224}$ second, so that a person speaking 120 words per minute would cover 56 feet of tape with each word. Such an extension of the record of the vibrations evidently makes it impossible for me to read writing on the tape, however useful the method may be for minute analysis or for studying the swing of the phonographic disc. Without going into controversies and minutiæ which do not especially interest an otological society, it may be stated briefly that by the methods of research indicated it has been made out that in sounding vowels, certain partials, different for each vowel, are reinforced more strongly than others, and that

when the same individual sings the same vowel on the same note the same partials are strongly reinforced. A partial may be so strongly reinforced as to obscure the fundamental and lead to deception regarding the pitch of the compound note. Whether the pitch of the predominant partials depends on the pitch of the fundamental or is constant cannot be said to be quite settled, nor can it be said to be settled whether the peculiar quality of a vowel depends absolutely on the amount of reinforcement of certain partials or on the ratio between the reinforcements of the predominant partials.

The point which interests an otological society most is the movement of the phonographic disc. In connection with a given sound one has to consider (1) Pitch, (2) Intensity, (3) Quality.

Now, we have already seen that pitch is not quite simply dismissed. If I take a line tracing from a fork which gives 100 D. V. per second, I obtain a series of perfectly uniform curves. But suppose that the tone was a compound one, and that on each of the uniform curves we found eight little elevations. What would be the pitch of the note? Would the pitch be increased to 800 D. V. per second? That is just the difficulty which presents itself in the case of the vowels, and that is the difficulty which presents itself in taking graphic tracings. Unless we are very careful in the apparatus chosen, we may obtain the gross vibrations without the fine ones; or, on the other hand, we may add to our tracings vibrations peculiar to the apparatus itself. Now, we fancy that we may grant that each pit on the wax cylinder of the phonograph counts and has its own significance, because free vibration of the plate is damped both by the horseshoe weight and by the resistance of the hard wax to the cutting point; moreover, by running over the pits with a blunt point, the sounds are exactly reproduced. It is of enormous interest, therefore, to try to determine what exactly is the movement of that phonographic disc.

I will show you first that it takes occasional swings which are easily recorded by apparatus which will not record the fine vibrations. We call this a record of *change of intensity.*

I have here a microphone consisting of a metal box packed with carbon and having the side next to the mouth-piece closed by a ferrotype plate. If I speak into the mouth-piece the ferrotype plate vibrates and subjects the carbon to pressure each time it swings inwards. If I pass a constant current through the microphone, the resistance being lessened each time the carbon is compressed by the ferrotype plate, it is evident that every variation in intensity of sound will influence the amount of current passing.

I make arrangements to utilise the variation of current in order to obtain a record of variation of intensity of sound. The current is led to electromagnets which pull on the bottom of an air-tight thin iron box, from which proceeds a tube which is connected to a very finely constructed piston, with a lever attached to it, working in a little metal cylinder. Now when the current is stronger the bottom of the thin metal box is more pulled down and the piston descends. You observe that the piston and lever are beating time to every variation of intensity of the song reproduced by the phonograph. Yet such an arrangement does not answer to the fine vibrations. I now connect the apparatus to a Brodie's tambour used in every physiological laboratory and you see that the recording lever again beats time to the music. I connect straight from the microphone to a time-marker such as is used for obtaining time tracings. You observe that the lever again beats time to the music. We can record the movements of the lever on a smoked cylinder and thus obtain records of changes of intensity of sound or in other words of the gross swings of the phonographic disc.

To demonstrate difference of quality to sounds to you I use an arrangement due to McKendrick in which a lever with writing point attached directly to the blunt point on the under surface of the phonographic disc is made to record the vibrations of the disc on the quickly moving glass plate of his "railway" myograph used for other purposes. I first take a 100 D.V. time tracing on the glass plate and then I sing the vowels in succession into the mouth-piece and obtain a tracing of the vibrations of the phonograph disc for each on the glass plate. I show you the result in the lantern. You observe that each vowel has a characteristic tracing which is always the same for the same individual. You observe that by means of the time tracing I can count the number of vibrations corresponding to any vowel occurring in any given number of hundredths of a second and can thus determine the "pitch" of the vowel if we are to denote by pitch the greatest observable number of vibrations per second. I show you magnified tracings of the vowel "i" which bring out its very high pitch, or rather, to be more accurate, the very high pitch of its predominant partial.

Lastly, as an interesting and entertaining experiment, I show you the singing arc-light. The current to the arc-light is passing through a primary coil around which is a secondary through which is passing a current which also passes through a microphone in the next room. If I sing into the microphone I cause variations in the current passing through it, which variations react on the current

passing through the primary coil to the arc-lamp. How exactly these latter variations cause my voice to be reproduced from the arc-light I cannot explain.

Conclusions.

1. Vowels are musical tones produced in the larynx, but they owe their special quality to the fact that the laryngeal tone arouses by resonance mouth tones, which are added to the laryngeal tone, or they may even mask it to such an extent that the laryngeal tone may scarcely be heard.

2. The pitch of these mouth tones need not be necessarily simple multiples of the pitch of the laryngeal tone, but they often have this relation. The pitch of the mouth tones is variable owing to the possibility of infinitely small changes in the form and capacity of the pharyngeal, oral, nasal, and other cavities of the throat and face, depending on the individual, and thus we may say there are hundreds or thousands of vowel sounds, as may be illustrated in the Arabic and Chinese languages. But while this is so the variation is never beyond a certain limit, within variable limits for each individual, so that a certain vowel—a, for example —is always recognisable.

3. The vowel being produced by simultaneous sounds of different pitch and intensity, it follows that the tympanic membrane has the power of taking up such vibrations simultaneously, and, since we distinguish the vowels, that the ear has the power of transmitting them so that they are analysed and recognised by the higher centres. Indeed, it is possible that the analysis first takes place in the internal ear, and that the results affect groups of cells in the higher centres differently.

Many interesting problems arise, demanding more precise information than we possess, which can best be solved by otologists, who must have among their patients many who have trained ears.

1. Is the power of distinguishing pitch ever retained while that of distinguishing quality is lost? If so, under what conditions?

2. Is the lack of power to distinguish phase universal?

3. How do (1) Disease of tympanic membrane; (2) Disease or ankylosis of ossicles; (3) Disease of internal ear; affect sense of pitch or of quality?

Cases of disease of the internal ear are especially interesting as bearing on the question of an analysis of the compound sound wave taking place there.

THE FOLLOWING COMMUNICATIONS WERE TAKEN AS READ:—

Mr. RICHARD LAKE communicated a *Brief Note on Testing the Hearing with the Higher Tuning Forks; derived from Tests made in a Case of Removal of the Necrosed Labyrinth, together with the Membranous Cochlea. Shown in December,* 1901.

The remarks of the President at the last meeting of the Society with regard to the anomalous results occasionally obtained from Weber's tests after removal of a necrosed labyrinth suggested that a few remarks on the subject might be worth the attention of the Fellows.

Dr. Randall, in a paper he read at the American Otological Society in July, 1902, brought this subject up, together with a list of cases in which the effect on the hearing was stated in some proportion. In one the cochlea was removed, and there was some hearing. In another, reported by Goldstein, which was not given in this list, but was reported in the JOURNAL OF LARYNGOLOGY some years ago, some hearing was found to remain.

This makes three in all wherein some hearing remained; but I think we may fairly assume that when the total membranous cochlea has been removed or has been destroyed by disease, no hearing persists, but where the membranous cochlea remains, a small portion may be functionally active. In the case I had the honour of showing, I recently submitted the patient to a careful examination with the following results:—

He is a man aged fifty-seven, an intelligent artisan. Weber's test was positive on the right side. On the left side, which was the side operated on, there was no bone conduction whatever with any tuning fork, but when the acoumeter was placed in contact with that side of the head, he said that, although he heard it, he was unable to say that it was with the right ear. From this I think we may assume that bone conduction by means of the acoumeter, in grave nerve deafness, is useless for diagnostic purposes.

On the right-hand side he had a loss of twelve seconds in his air conduction with C^4 tuning fork.

I now proceed to attempt to determine to what extent the tuning forks would be heard with the sound ear, when that was tightly closed, and the tuning fork held on the opposite side of the head. The result of these observations was that no tuning fork held thus could be heard below C^3, that if C^3 was struck sufficiently hard it would be heard by the sound ear to within thirty seconds of its ceasing to vibrate, and C^4 forty-five seconds.

Deducting from this forty-five seconds the twelve seconds which were lost in air conduction on the sound side, we have then left the fact that if a tuning fork of high pitch is struck with too great violence, the sound may be perceived by the sound ear, and attributed to the diseased one, if the duration of its vibration is over thirty seconds, and this might apply also to lower-pitched tuning forks, if they were struck so as to obtain over-tones.

I may also say in connection with tuning fork tests, that I consider it extremely probable that the diminution in the bone conduction noticed with increasing age is due in part to the gradually increasing porosity of the petrous bone, and to the consequent difficulty which sound has in penetrating it, especially in the case of high tones.

Mr. RICHARD LAKE reported a *Case of Suppurative Disease of the Temporal Bone, with the Principal Extension into the Petrous Portion.*

The patient, a lad of nineteen, presented himself at the hospital, suffering from slight discharge from the left ear and attacks of vertigo.

Previous history.—The history he gave was that nine years ago he was struck in the left ear with a tennis ball. A week or so afterwards he had an attack of influenza, with severe pain in his left mastoid, but he states that at no time did he have any discharge from the ear. The pain continued for four months, always coming on about eleven o'clock at night, and lasting for about an hour, gradually increasing in severity. He became unconscious one night, and was operated on the next by Mr. Stanley Boyd, who has been kind enough to give me the following particulars:

Seen with Dr. Michie December 3, 1903. Had suppurative otitis media two months ago (side?). Membrane perforated; discharge; got better for a month. After a tram ride severe pain returned, with fever and swelling behind ear. This swelling varied. Pain, fever, and loss of sleep said to have rendered him weak and anæmic. Has had one, perhaps more, rigors.

I found him very pale and weak. Little discharge from meatus; no swelling over mastoid. Swelling and tenderness below ear, where a gland is enlarged. No signs of cerebral abscess.

Pinna turned forward by usual incision. A little pus escaped. Collection probably drained imperfectly into external auditory canal. Antrum opened: it was large and lay low. It was cleared out, iodoformed and plugged. I did not see the boy again.—S. BOYD.

Present state (1904).—The operation wound healed satisfactorily, and the boy was relieved of his pain. He has been suffering with attacks of vertigo for some months.

On examination the external meatus was stenosed about half an inch down, an orifice about the size of a pin-head only being left, from which exuded a thin and slightly offensive discharge.

He was admitted into the hospital, and on March 1 put under an anæsthetic. On reflecting the ear, the bone was found to be as dense as I have ever seen it, and showed traces of the old operation. When one arrived at the level of the stenosis, one found that the bony canal itself was much stenosed, and that the hole in the membranous meatus was plugged by a dense mass of inspissated pus and epithelium. The extreme density of the bone rendered it easier now to have resource to the burr. The bony meatus was cut out to its right level below, and the radical mastoid operation performed as rapidly as possible. The antrum itself was extremely small. The whole of its cavity, and that of the middle ear, was full of cholesteatomatous material, and a large sinus was found leading deep into the petrous bone. The diseased bone in this region was rapidly cleared away, and as a result the upper surface of the external semicircular canal was exposed in its entirety, the major portion of the posterior canal also; the superior, however, was not brought into view, the external semicircular canal having the appearance of being supported on a pillar of bone, which contained the facial nerve. The bony canals were almost of a dazzling whiteness.

The wound was treated in the ordinary way and grafted on the fifteenth day, the condition of the wound showing no features of interest. The case, however, is one of considerable interest, as being one of a class of cases which seem to form a link between intra-labyrinthine suppuration and necrosis of the labyrinth; for had this case proceeded, unrelieved by operative measures, one of two endings must have followed—either the pressure of the cholesteatomata would have caused an erosion, and eventually penetration of one of the semicircular canals, thereby setting up an intra-labyrinthine suppuration, or the infective osteitis would have invaded and destroyed the cancellous bone surrounding the labyrinth, thereby cutting off its nutrition, and necrosis of the labyrinth would have followed. Or even a third local condition might have followed, which would have been a combination of these two. Cases somewhat similar have been recorded both on the Continent and in America.

It may be interesting to mention here in this connection that it was impossible to see the foramen ovale even when all hæmorrhage was controlled and the parts quite dry.

Dr. A. Brown Kelly showed *Cases of Insufficiency of the Palate, and its Relation to Affections of the Ear.*

Dr. Brown Kelly said: The cases of insufficiency of the palate have been shown because of their rarity—not one having been reported in the United Kingdom so far as I know—and in order to point out the influence exercised by this malformation on the ears.

The boy presents a deep notch in the posterior edge of the hard palate, and the soft palate is drawn forward in consequence so that it cannot reach the posterior wall of the pharynx on phonation. This case conforms to the view generally held regarding insufficiency of the palate, namely, that the fundamental cause is a shortening of the hard palate, and not of the soft palate.

In order to prove, however, that notching of the hard palate does not always give rise to insufficiency the second patient has been shown. This man is one of eleven cases I have met with in which there was notching of the hard palate but no insufficiency of the soft palate.

The girl's condition proves that insufficiency may exist although the hard palate is of normal length and contour, and the soft palate not shortened. In this case the chief place of elevation of the palate is not at the base of the uvula as usual, but close behind the posterior edge of the hard palate. This abnormality seems to me to be probably due to defective interlacing of the posterior portion of the levator palati with that of its fellow of the opposite side, hence the posterior part of the soft palate is but slightly raised.

I have had five cases of insufficiency of the palate, and in all of them the ears were, or had been, affected. In four of the patients there was more or less permanent deafness, and in one occasional deafness. Recurrent earache was complained of by three, and a history of otorrhœa was given by two. The examination of the ears showed the affection to be chronic middle-ear catarrh in three instances, Eustachian catarrh in one, and chronic suppurative otitis media in one.

Insufficiency of the palate therefore seems liable to be associated with affections of the ear. The manner in which the latter are produced is not clear, but two factors appear to me to be of importance in this connection: first, defective ventilation of the middle ear owing to the restricted action of the levator and tensor palati; second, extension of inflammation from the naso-pharynx, which, owing to its abnormal roominess and the patient's difficulty in clearing it of secretion, is apt to become the seat of chronic catarrh.

Dr. JAMES GALBRAITH CONNAL communicated a paper on *The Treatment of Dulness of Hearing and Subjective Noises in the Ears by High Frequency Currents.*

The following observations were made in conjunction with Dr. James R. Riddell, Medical Electrician to the Glasgow Royal Infirmary, to determine, if possible, the influence of high frequency currents in the treatment of dulness of hearing, and subjective noises in the ears.

The cases were not selected in the sense of being considered to be cases favourable for treatment. In every one of them other methods of treatment had been employed but found ineffectual. For instance, in chronic dry catarrh of the middle ear, catheterisation of the Eustachian tube, or inflation of the middle ear by Politzer's bag, had been tried. In nearly all cases complaining of tinnitus aurium, drugs, such as the bromides, hydrobromic acid, or strychnine had been used unsuccessfully. In addition, any nasal defect which might possibly have an influence on the aural condition was rectified. If recognised methods of treatment failed to effect any improvement on the dulness of hearing or lessen the subjective noises these patients were sent to Dr. Riddell.

It will therefore be seen that, for treatment by high frequency currents, the cases were of a class not readily influenced by ordinary methods of treatment. Notes were taken of the tuning-fork reactions; the hearing distance of the watch was also noted, and this was checked after the treatment had been discontinued.

In all, forty cases were treated. I have been unable to follow the results in eight of the cases, owing to the patients either discontinuing the treatment, or failing to report themselves after the treatment was finished. This leaves thirty-two cases.

The types selected were (1) chronic dry catarrh of the middle ear with secondary labyrinthine involvement; (2) chronic dry catarrh of the middle ear without marked labyrinthine involvement; (3) sclerosis of the middle ear; (4) post-suppurative conditions of the middle ear (the purulent process having ceased), leaving a cicatrix or a dry perforation with or without calcareous deposit in the tympanic membrane; (5) primary labyrinthitis (traumatic); (6) tinnitus without dulness of hearing.

In all the patients selected both ears were involved, one ear being generally worse than the other. In two cases, though both ears were involved, there was a different disease on either side, namely, a chronic dry catarrh on one side, a post-suppurative condition on the other.

1. *Chronic dry catarrh of the middle ear with secondary labyrinthine involvement.*—These patients (six in number), in addition to marked defect in hearing, had tinnitus. Some had occasional attacks of giddiness. Result.—No improvement in the hearing in any of them. In four, the tinnitus persisted; two patients thought the noises were slightly lessened, but were very indefinite about it.

2. *Chronic dry catarrh of the middle ear, without marked labyrinthine involvement.*—(Fourteen cases). In ten, no improvement in the dulness of hearing; one said she was worse; two noted a slight improvement in the hearing. On the other hand, one patient said she heard much better, but this improvement was not appreciable by any tests that were applied. Ten of the fourteen patients complained of tinnitus of various types, though the prevalent type was a low-pitched hissing sound. Of these ten patients with tinnitus, eight reported an improvement—that the noises were not heard so loudly; two of the eight said they were "much better." In only one case did the noise disappear entirely, namely, a female patient with tinnitus likened to steam escaping, and occasionally a beating or ticking sound. The noise persisted in the right ear, but ceased in the left ear for six weeks, when it recurred.

3. *Sclerosis in the middle ear.*—(Five cases). One patient said she heard much better, but on testing with the watch the improvement was not apparent. The patient and her mother, however, were emphatic that she heard much better. Unfortunately in this case the hearing distance for the voice had not been noted previously. The other four patients reported an improvement in the hearing, which was confirmed on testing with the watch. There was also a decided improvement in the tinnitus.

Lizzie I——, aged twenty-two.—Ringing noises in the right ear for four years, but did not consider herself dull of hearing till one year ago. W. R. $\frac{1}{40}$, W. L. $\frac{20}{40}$. Tympanic membranes little altered in appearance from normal. Eustachian tube free. With treatment the hearing improved in right ear to W. R. $\frac{6}{40}$, W. L. $\frac{20}{40}$. The tinnitus, like bells ringing, however, was persistent. After an interval of time, and no further improvement being noted, she was sent to Dr. Riddell for the high frequency current; she was greatly benefited by the treatment. Tests showed W. R. $\frac{14}{40}$, W. L. $\frac{27}{40}$. She has had no ringing noises in the ear for four months.

Mrs. M. L.——, aged twenty-six.—Noise like steam escaping in the left ear, of one year's duration. Lately noise has begun in the right ear. Dulness of hearing in both ears, W. R. $\frac{4}{40}$. W. L. $\frac{1}{40}$; tympanic membranes, especially left, appear somewhat indrawn. Nose and nasopharynx normal. Eustachian tube quite patent.

Inflation of the middle ear by catheter lessened the sounds slightly, but only temporarily. Inflation had no influence on the dulness of hearing. After treatment by high frequency currents she said the noise was not nearly so loud, and that she heard better W. R. $\frac{9}{40}$, W. L. $\frac{2}{40}$.

Janet S——, aged twenty-eight. Deafness in left ear of two years' duration, and in right ear of one year's duration. Never had tinnitus. W. R. $\frac{3}{40}$, W. L. $\frac{4}{40}$. Nose and nasopharynx normal. Eustachian catheter passes easily and shows tube quite patent. Diagnosis: Chronic dry catarrh, but more of the sclerotic type. She derived no benefit from inflation of the middle ear, but after treatment with high frequency current there was a decided improvement noted, W. R. $\frac{30}{40}$, W. L. $\frac{16}{40}$. I tested the hearing distance with the watch on several occasions, and though there was a slight tendency to guesswork which I could not exclude, still I think the result stated may be taken as correct. For conversational tones and whispered conversation the hearing was very good. The patient herself affirmed that she heard splendidly.

Annie V——, aged twenty-seven. Deafness in both ears of four years' duration. Beating tinnitus in the left ear, W. R. $\frac{3}{40}$, W. L. $\frac{3}{40}$. Tympanic membranes almost normal in appearance. Catheter passes freely but does not improve hearing. After high frequency currents said she heard better. W. R. $\frac{5}{40}$, W. L. $\frac{3}{40}$. Tinnitus almost entirely away.

4. *Post-suppurative condition of the middle ear* (seven cases).—Four, as the result of treatment, reported a slight improvement in the hearing, and examination showed a fractional increase in the hearing (fractional = up to one inch); five of the seven cases had tinnitus, and four of these five reported themselves as much better.

One case of primary labyrinthitis (traumatic), and one case of tinnitus without dulness of hearing derived no benefit from the treatment.

To sum up, in trying to estimate the benefit obtained from the treatment by high frequency currents it must be remembered that the class of case chosen was one not readily amenable to treatment. The majority of the patients had chronic dry catarrh of the middle ear, with, in some cases, secondary labyrinthine involvement. It is unnecessary to point out to those present who have experience of the outdoor department of an Ear Hospital, with what persistence these cases attend in the hope of getting some relief, either from the dulness of hearing or the subjective noise. Hence it is necessary to allow for the mental factor in estimating

the improvement said to be the result of treatment. Our methods of testing dulness of hearing, though not perfect, are fairly satisfactory, but unfortunately we have no means of testing either the accuracy or the extent of the subjective noise. With regard to the latter we must accept the patient's statement.

Taking then the chronic dry catarrhs with secondary labyrinthine involvement (six patients), there was no improvement in any of them. Two patients, however, thought the tinnitus was slightly lessened.

Ten of the cases of chronic dry catarrh had tinnitus. Eight of these ten reported an improvement in the tinnitus, two being much better. In two of the fourteen cases a fractional improvement in the hearing was noted. This improvement may have been due to the lessening of the subjective sounds.

In post-suppurative conditions five of seven patients had tinnitus and four of these five reported themselves as much better. In four cases there was a fractional improvement in hearing.

In sclerosis of the middle ear all five patients reported an improvement in the hearing, which was confirmed on testing—with one exception to which I have already referred, where both the patient and her mother were positive as to the improvement, but on testing with the watch I was unable to confirm it. Regarding the others the improvement was marked in three, and slight in one. Those patients who had tinnitus all derived benefit. In one case which I have quoted where there was persistent tinnitus before the treatment, there has been no noise for the last four months, and the improvement noted in the hearing has been maintained.

The number of cases of this type (sclerosis) is too small to do more than suggest further investigation. Still, it is hopeful, and to myself the results were rather surprising, so much so that I tested the patients on several occasions.

In all the groups examined it will be noticed that the greatest benefit was obtained in the treatment of subjective noises. Taking these *en masse*—apart from the types—twenty-six patients complained of tinnitus, and of these seventeen were improved. In one case the noise was not heard in the left ear for a period of six weeks, when it recurred; in another patient there has been no tinnitus for four months.

I am aware that the results obtained are rather better than those got by other observers, but I would urge that there is something in how the current is applied. I have the less

hesitancy in emphasising this point as the electrical treatment was entirely carried out by Dr. Riddell, and was in accordance with his ideas.

As is known, the common method of applying the current is by means of the effleuve (or spray). This was the method adopted in our earlier cases, but it was found unsatisfactory. Dr. Riddell then introduced a method which, so far as we know, has not been used in ear work—by means of a condenser electrode placed in each ear. It is probable that in this way the current is more completely concentrated on the ears. This latter method gave better results. The case of sclerosis which I have already quoted was first tried by the effleuve without any effect, but after eight applications with the condenser electrode in the ears the noise ceased. Other patients in like manner affirmed that it was the method which did them most good.

The treatment is purely empirical, but I think it is worth a trial on the lines on which Dr. Riddell worked.

In conclusion I have to thank Dr. Riddell for the interest he has taken in the investigation.

Mr. MACLEOD YEARSLEY reported a *Case of Traumatic Atresia of the Meatus Successfully Treated by Operation.*

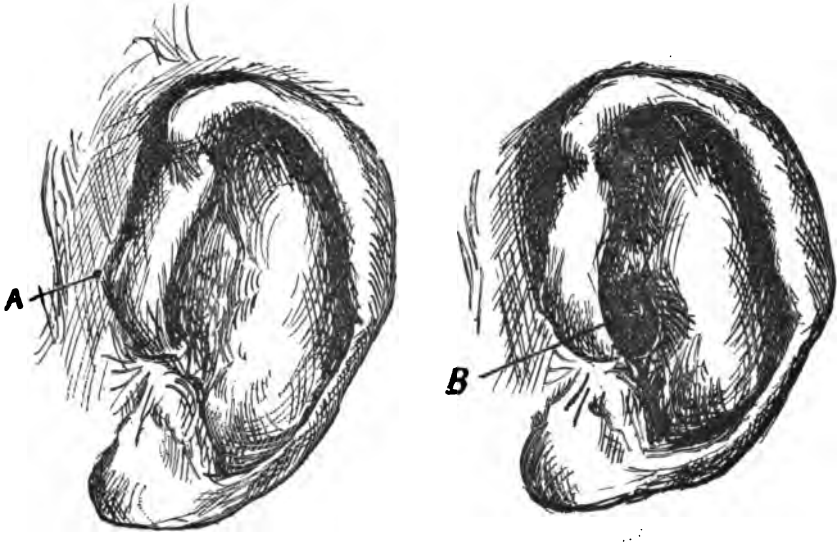
The patient, J. R——, aged forty-three years, was first seen on September 18, 1901. He was thrown out of a cart fourteen years before in Australia, when his left auricle was nearly torn off. The ear was readjusted, but in the after-dressing the tube was not properly inserted and the meatus became closed. A pin-hole orifice opened of itself in front of the lower part of the helix six to nine months later, from which a slight serous fluid exuded occasionally.

Eighteen months before consultation he began to complain of pain in the left ear, preventing sleep. There was tinnitus, with a feeling of great fulness and headache. On examination the ear presented the cicatrised condition shown in the sketch (I). Practically the whole concha was filled with firm fibrous tissue. In front of the lower part of the helix was a very small opening, which admitted only a Hartmann's probe (A, in Sketch I). The watch was heard faintly on pressure, and there was no loss of bone-conduction to the tuning-fork.

Chloroform was administered on November 6, 1901, and the auricle and membranous meatus were turned forward by a semicircular incision over the mastoid. The whole meatus was found to be full of a non-offensive sebaceous-like material. This was care-

fully removed, and the membrane tympani was found to be intact. An incision was made through the cicatricial material which filled the concha, and as much fibrous tissue as possible was dissected out. The membranous meatus was then split in two places, and the resulting flap attached to the under surface of the skin flap by two sutures, tied over rubber-tubing. The meatus was packed with gauze and the primary incision closed.

Recovery took place somewhat slowly, the new meatus gradually becoming lined with granulations. On November 16, he could



I. *II.*

hear the watch at twenty-one inches. Packing was discontinued on November 20, and a specially made leaden tube inserted. It had been originally intended to graft, but he took the anæsthetic so badly that it was not thought worth the risk to subject him to a second operation.

He was last seen on January 28, 1903, when the second sketch (II) was made, showing the new meatal opening at B. He had lost all his pain, tinnitus, and headache, and could hear very well indeed. The meatus was then lined throughout with epithelium, and although the orifice still tended slightly to contract, the patient stated that he could easily counteract this by occasionally wearing his tube at night.

The President showed a *Case of Temporo-sphenoidal Abscess*

operated upon by Sir Wm. Macewen seventeen years ago. Interesting historically as one of the first cases of the kind.

W. H——, a man aged twenty-seven. In January, 1887, when ten years of age, patient came under Dr. Barr's care, presenting the classical symptoms of right temporo-sphenoidal abscess supervening on a purulent discharge from the right ear of a year's duration. At the request of Dr. Barr, who knew of Barker's case occurring a few months before, Dr. Macewen trephined an inch above the meatus, with a counter-opening at the roof of the meatus. A large temporo-sphenoidal abscess was evacuated, followed by complete recovery. He is now, seventeen years afterwards, in excellent health, both bodily and mentally, a brass-founder to trade, married, and has two children. The case was reported fully in the *Lancet* of March 26, 1887.

The President and Dr. J. H. Nicoll showed—(a) *Case of a man, aged thirty-four, who was operated upon for Cerebellar Abscess by Dr. Nicoll six years ago.* (b) *Case of a man, aged twenty-eight, suffering from a Sense of Pulsation in Left Ear, in which a Pulsating Bruit was heard through the Auscultation Tube, and was unrelieved by Ligature of Vessels.*

(*a*) T. B——, a man aged thirty-four. Six years ago Dr. Barr performed the radical mastoid operation on the left side, exposing the lateral sinus, which was healthy. A few days afterwards Dr. Nicoll opened the cranial cavity, first over the temporo-sphenoidal lobe, with negative result; then over the cerebellum, behind the sigmoid part of the lateral sinus, and an abscess was tapped in the cerebellar tissue half an inch from the cortex. Afterwards, on account of the continuance of discharge from the abscess cavity, an aperture was made in the cerebellar fossa in front of the sinus, through the posterior surface of the pars-petrosa with good results. The patient is now engaged as a packman, carrying heavy burdens sometimes fifteen miles in the course of a day. The case is fully reported in the *Transactions of the Glasgow Medico-Chirurgical Society*, vol. ii.

(*b*) W. S——, a man aged twenty-eight, had had constant beating, "like a pulsation," in left ear for several years, arising apparently from a severe blow upon the head inflicted with a large stone. By auscultation a distinct bruit, synchronous with the pulse, was heard in the ear. This was stopped by pressure on a particular spot behind the mastoid. The watch was heard in right $\frac{4}{40}$, in left $\frac{17}{40}$. Speech, however, was not heard so well in left as in right ear. The posterior auricular artery and the external carotid artery

were ligatured about three months ago by Dr. Nicoll without effect upon the pulsation, so far as the patient's sensations were concerned. The bruit, however, is not now heard through the auscultation tube.

The PRESIDENT and Dr. JAMES GALBRAITH CONNAL showed two *Cases in which Large Exostoses were removed from the External Auditory Canal by the Post-auricular Route.*

J. S——, a man aged twenty-one, from whom a bony growth, which filled the lumen of the meatus and compressed the walls, was removed by Dr. Barr from right meatus in December, 1902. After the dissection of the auricle and external auditory canal forward, the exostosis was removed from the back wall with mallet and chisel. Before the operation the watch was heard only on pressure, and a whisper was heard close to the ear. Now the watch is heard thirty-six inches from the ear, and a whisper the length of a moderately-sized room. The hearing of the opposite ear is defective. The bony growth was shown to the Society.

Dr. W. S. SYME showed the following patients:

1. *A Case of Radical Mastoid Operation in which no Antrum was found, the Antro-tympanic Passage being very narrow and ending abruptly in Sclerosed Bone.*

The patient was a male aged twenty. There had been purulent discharge from the left ear for ten years, which was unaffected by ordinary antiseptic treatment.

Operation.—The supra-meatal spine was well marked, but the supra-meatal triangle was not so clearly defined. In its place was a small pit, and the bone was otherwise rounded, and the mastoid sloped sharply to the meatus. On removing the bone, which was sclerosed, with the chisel, an opening was found from which, however, no purulent material escaped. The bur was then used, and it was seen that this opening led to the sinus, and through the thin shining plate of bone left by the bur the sinus could be plainly discerned close up to the posterior meatal wall. The bone was then cautiously removed by the bur nearer to the meatus and higher up to a depth of half an inch, when facial twitching indicated proximity to the Fallopian canal, but no antral cavity was found. The point of a Stacke's protector was then passed into the aditus and the bone removed over it. The passage was then seen to pass almost directly upwards, to be very narrow, and to end abruptly without expanding into an antral cavity.

The hearing had improved from watch = pressure before operation to watch = $\frac{2}{40}$.

2. *A Case of recent Radical Mastoid Operation, Left Ear, showing the Result of early Discontinuance of Packing.*

The patient was a male, aged sixteen.

The Operation was performed April 19, 1904, for purulent discharge of some years' standing, with granulations.

The antrum only was involved, the vertical cells being unaffected. The posterior wall of the cartilaginous meatus was split and the posterior wound immediately closed. The cavity was then tightly packed through the meatus, and the meatal flaps thus pressed into position. On the twelfth day the stitches were removed and the bandage and dressing left off.

Light packing was continued for four days. Since that time the granulations had been kept down by spirit treatment, and four weeks and four days after the operation the cavity was almost completely epithelialised.

Dr. SYME thought that from the localisation of the disease this case was particularly suited to this method of after-treatment. Before operation, watch = P.; May 21, watch = $\frac{7}{40}$.

Dr. R. FULLERTON showed the *Case of a Lad on whom the Radical Mastoid Operation had been performed Fifteen Months previously.*

At the operation the structures in the middle ear were found to be quite disorganised by a chronic suppuration, the bony tissue surrounding the antrum was to a great extent destroyed with exposure of the lateral sinus, while the antral cavity was filled by cholesteatomatous masses, granulations and pus. The after treatment consisted in packing with boracic powder and iodoform gauze through the meatus, and the surface of the cavity had become entirely lined with epithelium in eight weeks. When seen two months later the aural cavity was clean and dry. Cholesteatomatous concretions were now present, especially on the posterior portion of the cavity, and the general surface was moist. The case was shown with the object of drawing attention to this troublesome condition, which so frequently follows such operations, and of eliciting information as to whether it occurs more frequently in cases where cholesteatoma previously existed.

Dr. ALBERT A. GRAY showed *Specimens illustrating the Anatomy of the Internal Ear.*

The macroscopic specimens of the labyrinth were prepared by

a method devised by himself, and showed that structure in its entirety. In the specimen stained with osmic acid the various nerves were seen running to their terminations in the cochlea, the maculæ acusticæ, and the cristæ acusticæ respectively. In one of these preparations a rudimentary ampulla was found in addition to the normal one.

Another preparation was shown in which the endolymph spaces had been injected with lampblack, and a third which showed the aquæducts of the vestibule and the cochlea.

Specimens of the auditory ossicles of the seal were also shown.

The microscopic specimens showed the cochlea and organ of Corti in certain mammals. In the section of the human cochlea the helicotrema was clearly seen. The organ of Corti of the mole showed the spiral termination of the nerve round the hair-cells in a way not seen in other animals. The section of the organ of Corti of the mouse was noticeable for the clearness with which the different elements of that structure could be seen.

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